

The background of the book cover is a photograph of a wide, powerful waterfall cascading over a rocky ledge. The water is white and frothy as it falls, creating a large plume of mist at the base. The surrounding landscape is lush with green tropical vegetation, including dense forests on the banks and distant hills under a blue sky with scattered white clouds.

The Use of Biodiversity Data in Developing Kaieteur National Park, Guyana for Ecotourism and Conservation

by
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Edited by
Phillip DaSilva
and
V.A. Funk

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CENTRE FOR THE STUDY OF BIOLOGICAL DIVERSITY
UNIVERSITY OF GUYANA

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ABSTRACT

Carol L. Kelloff. Smithsonian Institution. The use of biodiversity data in developing Kaieteur National Park, Guyana for ecotourism and conservation. *Contributions to the Study of Biological Diversity*, volume 1: 46 pages (including 8 plates).- Under the auspices of the National Protected Areas System (NPAS), Guyana is developing policies to incorporate conservation and management of its tropical forest. Kaieteur National Park was selected as the first area under this program. Information on the plants (and animals) is vital in order to make informed conservation or management policy for this unique ecosystem of the Potaro Plateau. Understanding and identifying important ecosystems and the locations of endemic plant taxa will assist Guyana in formulating a comprehensive management and conservation policy that can be incorporated into the development of Kaieteur National Park.

KEY WORDS: Guyana, Kaieteur, conservation, management, biodiversity

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The Use of Biodiversity Data in Developing Kaieteur National Park, Guyana for Ecotourism and Conservation

Carol L. Kelloff¹

INTRODUCTION

Guyana is a small country encompassing an area of about 215,000 square km and is located on the Atlantic seaboard of northeastern South America (Figure 1). It is one of the six countries that lie over the rich biogeographic region of the Guiana Shield. On the Shield, Roraima sandstone forms the Pakaraima Mountains in northwestern Guyana and extends into the Venezuelan Highland as a series of table-top mountains (Gibbs and Barron, 1993). Guyana is covered with a rich rain forest and a variety of other natural habitats. Over 70% of the country is still covered with forest, ranging from montane and lowland evergreen rain forests to dry evergreen and seasonal forests (J. Singh, pers. comm.) Tropical dry savannas of the Rupununi extend into Brazil while tropical wet

unique geology, tropical climate and an ecosystem that has remained relatively free of human disturbance makes Guyana rich in biological resources.

Underlying these biological resources, Guyana is rich in mineral resources such as bauxite, diamonds, gold, kaolin, and manganese (Oleynik *et al.*, 1999). In the past few decades, pressure has increased to exploit these resources for economic growth and national development. The burden of foreign debt and local poverty has increased the need for the Government of Guyana (GoG) to consider releasing larger tracts of land for mineral and timber mining. This has lead to environmental concerns expressed by both national and international parties. The loss of biodiversity on a global scale is being recognized by the international community. The importance of biodiversity to the environment, the economy, and to society led the United Nations Conference on Environmental and Development to hold a conference in Brazil in 1992. The purpose of the conference was to place emphasis on local and global resources and how nations can take actions to conserve and use biodiversity in a sustainable way. Since ratifying the Convention on Biological Diversity in August 1994, Guyana has agreed to develop strategies for environmental protection and natural resource conservation. Guyana recognizes that biological and other natural resources are major components of the national patrimony. One of the initial steps towards this goal was the production of the "National Strategy for the Conservation and Sustainable Use of Guyana's Biodiversity" (EPA-Guyana,

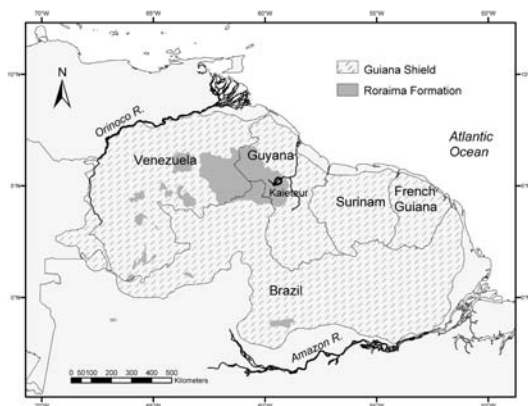


Figure 1: Location of Guyana on the Guiana Shield, northeastern coast of South America

and semi-wet savannas are centered on the Berbice River system. This combination of

¹: Biological Diversity of the Guianas Program, MRC 166, National Museum of Natural History, Smithsonian Institution, Washington DC 20013-7012, USA.

1997) to define its position on biodiversity. This process later produced the "National Biodiversity Action Plan" (EPA-GEF/UNDP, 1999) to promote the responsible use of biodiversity and biological resources and to develop a system for their conservation.

With the aid of international agencies, Guyana has developed a policy to incorporate the conservation of biodiversity and unique geological formations within the management of its tropical forests under the auspices of its National Protected Area System (NPAS). Kaieteur National Park is the first focus of the NPAS project. However, before the Government of Guyana (GoG) can initiate any informed conservation or management policy for this unique ecosystem, a basic knowledge is required of the plants and animals in the park, their relative abundance and location, and what areas may need further study. This paper examines Kaieteur National Park's present management and infrastructure and the current knowledge of the biological diversity of the park and provides some suggestions on developing the park for ecotourism and conservation.

Fear of global climate change, species extinction, pollution, and habitat destruction has caused the nations of the world to realize that forests are no longer an unlimited resource. It has been estimated that almost half of the six billion hectares of forest that once covered the earth are gone, and of the remaining forest 16 million hectares fall to the chain saw, bulldozer, or fire each year (Bryant *et al.*, 1997; Miranda *et al.*, 1998). What has developed in some areas of the world (such as eastern North America) is a mosaic of small or highly disturbed fragments of forest that have become refuges for some of the world's most endangered species, such as the spotted owl in northwestern United States (Arcese and Sinclair, 1997), the lemurs in Madagascar (Jolly, 1988; Mittermeier *et al.*, 1992), or the black caiman (Asanza, 1992) in South America. Although these fragments are still important for providing economic products and environmental services, they may not be able to sustain these uses in the long term.

However, the ecologically intact, relatively pristine natural forests may survive and continue to harbour and maintain a good

portion of the earth's biodiversity. These forests constitute approximately 22 percent of the original forest cover of the earth (Bryant *et al.*, 1997). In addition to providing ecological functions of climate stabilization and watershed protection, the natural forests are habitats for 50 – 90 percent of all terrestrial species still on earth. Large areas of natural forest provide habitat needed for the survival of far-ranging animals such as the harpy eagle, the timber wolf, and the grizzly bear. They are storehouses of genetic resources and homelands to much of the remainder of the world's indigenous peoples.

If the riches and resources of the forests are to be available for future generations, the concept of stewardship must be incorporated into precepts of how we, the citizens, businessmen, and policy-makers, use the forests. For the future of these and all forests, good stewardship may mean setting aside areas for complete conservation and preservation while other areas may need to be carefully managed for both timber and non-timber products.

There are only eight countries in the world that have large tracts of original forest remaining that are not yet under some form of threat. These countries are Russia, Canada, Colombia, Venezuela, Brazil, Surinam, French Guiana and Guyana (Bryant *et al.*, 1997; Miranda *et al.*, 1998).

Guyana's Forests

Geographically, Guyana is situated on the Guiana Shield, a granitic formation overlaid with sandstone, quartzite, shales, conglomerates and boulder beds (Fanshawe, 1952; Gansser, 1954). Contiguous with the Amazon Basin, the Shield represents one of the most intact parts of the region. Approximately 70% of Guyana's tropical forest (11.5 million hectares) remain intact. The forests may be classified as rain, seasonal, dry evergreen, montane, marsh, and swamp (Bernard, 1999). Guyana also has two classes of savannas: tropical wet and semi-wet savannas in the northeast and tropical dry savannas in the southwest of the country (World Bank, 1996). The different forest and savanna classifications are depicted on the ecoregion map of Guyana (Figure 2), based on the Preliminary Vegetation Map of Guyana (Huber *et al.*, 1995) that was compiled from existing

literature, LANDSAT-5 satellite images, and existing knowledge of the natural vegetation.

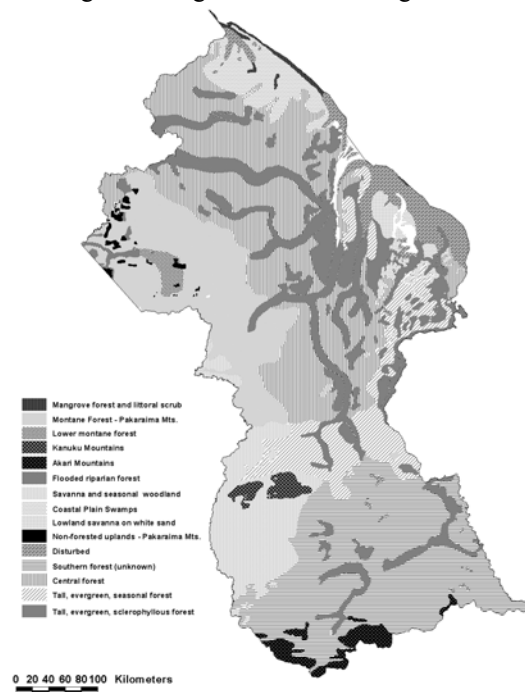


Figure 2: Map of the ecoregions of Guyana.

The forests of Guyana are relatively pristine in large part because of their inaccessibility, although the Guyana Forestry Commission (Guyana Department of Forestry-CIDA, 1989) considers approximately 3.6 million hectares (approximately 31% of the remaining forest) exploitable. Access into much of the interior of Guyana is possible only by small aircraft, boat or canoe, or on foot. There are very few roads into the interior beyond the coastal region, and on these pavement is replaced by laterite clay that becomes impassible during the rainy season. Approximately 95% of Guyana's 750,000 people live in the fertile area of the coastal plain, mainly from the capital, Georgetown, east to the Corentyne River. In the interior, or hinterland, about 35,000 indigenous people, collectively known as Amerindians, live in about 65 reserved areas scattered throughout the country (Guyana Department of Forestry-CIDA, 1989).

Forest Management in Guyana

Guyana is richer in biological diversity than either Surinam or French Guiana, due in part the diverse habitats of to the Pakaraima

Mountains in the northwestern region and the Rupununi savanna. However, it has lagged behind in setting aside land for conservation. Guyana's conservation tradition was nominal under the British (Sizer and Rice, 1995), and after independence in 1966 most initiatives focused on managing the forests. In 1979, the Guyana Forestry Commission (GFC) replaced the previous forestry service in the administration of timber resources. GFC drafted the National Forest Policy in 1985 and the National Forestry Action Plan in 1989. The objective of both of these documents was to efficiently manage forest resources, develop forest industries, and protect and conserve forest ecosystems and wildlife. The lack of adequately trained staff, funding, and infrastructure has made it difficult for GFC to implement and monitor its forest policy (The Tropenbos Foundation, 1991). It wasn't until the late 1980's that two initiatives began looking at conservation of Guyana's forests: The Tropenbos Programme and the Iwokrama Rain Forest Reserve.

The Tropenbos Programme, set up by the Government of the Netherlands, was established in Guyana in 1988 as the research component of Demerara Timbers Limited (DTL). Its mandate was to develop an appropriate management system for all forest types within DTL's 235,000-hectare concession near Mabura Hill. The Tropenbos Programme established a 900-hectare ecological reserve with an adjacent buffer zone in the area of Mabura Hill. The main objective of the Programme was to conserve and wisely use the tropical forest through knowledge of biological processes and to develop methods for sustainable development (The Tropenbos Foundation, 1991). Although several good projects have contributed to this research, culminating in a number of publications (*i.e.*: Ek, 1997) in the Tropenbos-Guyana Series (1 – 8), the Government of the Netherlands decided to restructure its Tropenbos Programme worldwide, and its work in Guyana ended in late 2001.

The Iwokrama Rain Forest Programme was established in 1989 when the Government of Guyana set aside 360,000 hectares of primary rainforest in the central portion of the country. The purpose of this reserve was to develop and

demonstrate methods of conservation and sustainable management of tropical forests (Hawkes and Wall, 1993; Pennington, 1993). Since its establishment, plant and animal surveys including birds (Ridgely and Agro, 1997); herpetofauna (Lee and Arjoon, ms.); mammals (Lim and Engstrom, 2001); plants (Clarke *et al.*, 2001); and fish (Watkins *et al.*, 2001) have been undertaken in this diverse, low-elevation rainforest by a number of organizations. These surveys are providing the framework for conservation and sustainable management efforts, as well as providing actual data for comparing Iwokrama with other areas in Guyana and with other countries (Clarke *et al.*, 2001).

In August 1994, Guyana ratified the Convention on Biological Diversity. With this ratification and several other related international treaties signed earlier; including the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Treaty for Amazonian Co-operation, and Convention Concerning the Preservation of World Cultural and Natural Heritage. Guyana's commitment to environmental protection and natural resource conservation was underway (World Bank, 1996).

Establishing a National Protected Area System

The first objective of the Government of Guyana was to establish the National Protected Areas System (NPAS) which would conserve globally-important biological diversity. The system was designed to work within Guyana's strategy for sustainable development by contributing to watershed protection and productivity, ecosystem and biodiversity conservation, and the maintenance of Guyana's cultural heritage (World Bank, 1996). There are a number of studies, reports, and documents that focus on the need, rationale, and criteria for selecting protected areas at a countrywide level, a regional level (Ramdass, 1990) or of a specific type such as a World Heritage Site or Biosphere Reserve (P. Hitchcock, pers. comm.). A problem with these reports is the lack of any type of procedure for selecting a proposed area. The design and implementation of NPAS was to encompass a full array of protected areas within

by the IUCN classification system (Appendix A). The first two areas under consideration for NPAS were the Kanuku Mountains, inhabited by the Harpy Eagle, and Kaieteur National Park. Since Kaieteur is the only legally established park in Guyana, it became the first priority of NPAS.

KAIETEUR NATIONAL PARK

Biophysical Setting of Kaieteur

The Pakaraima Mountains (Figure 3) extend for 73,000 square km or about 34% of

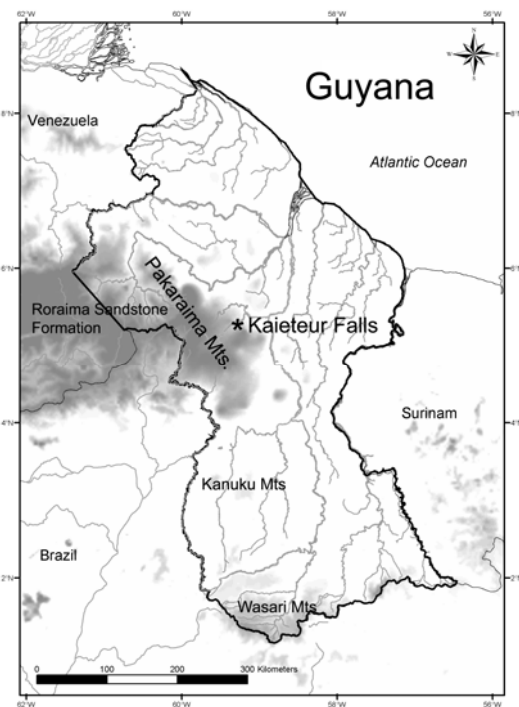


Figure 3 : Elevation map showing the extension of the Roraima Formation, the Pakaraima Mountains in Guyana, and the location of Kaieteur National Park.

the land area in Guyana (Gibbs and Barron, 1993). The mountains are located in the mid-western portion of Guyana and are part of the Roraima formation that also comprises a large portion of the Venezuelan Guayana. The geological formation of the Pakaraima Mountains are composed mostly of a sandstone conglomerate with rocks of quartz up to 7.5 cm in diameter. The range is comprised of a plateau

including table-topped mountains (tepui) and a series of steep-sloped escarpments. The average range in elevation of the Pakaraima Mountains is from 300 to 500 meters with the highest peak, Mt. Roraima, reaching (2,730 m).

The Pakaraima Mountains are the source of many rivers that are renowned for their waterfalls which drop off the edge of the escarpment. These include the Sakaika Falls on the Ekereko River and the Kamarang Great Falls on the Kamarang River (Bernard, 1999), but certainly the most famous waterfall in Guyana is Kaieteur Falls. It is the highest and most beautiful of the falls on the Potaro River, located where the Roraima formation gives way to the lowlands. Here the water from the Potaro River drops 226 m to the splash basin below after which it travels some 32 km through a gorge before leaving the escarpment behind.

Location and Size of the Park

Kaieteur Falls is the centerpiece of the national park. It was established in 1929 by the British Commonwealth and encompassed 11,400 hectares. In the early 1960's, the park's area were reduced to 1,940 hectares (19.4 sq. km), from Menzie's Landing to the Tukeit Rest House Compound (Department of Lands and Surveys, 1961). This was done in order to take advantage of the rich mineral resources (gold and diamonds) of the area (Lechner, 1997). The radar image (JERS-1 SAR) of the Potaro Plateau (Figure 4) provides an aerial view of the topography of the area. The 1973 boundaries (Figure 4) covered nothing more than the falls and an approximately 9.5 km stretch of the Potaro River. On March 9, 1999, President Cheddi Jagan issued an Order under the Kaieteur National Park Act of 1929 extending the boundaries of the Park to 62,680 hectares. The demarcation of the new park boundaries (Figure 4) fall within the limits of the "Peoples Cooperative Unit No. 812121, Division: Waratak/Echerak" and is defined as follows (Anon, 1999):

"Commencing at the mouth of the Haiabaru Creek at mid-stream, left bank Potaro River; extending thence up the mid-stream of the Haiabaru Creek to its source; thence in the westerly and southerly direction, along the watershed between the Potaro River on the east

and its left bank tributaries, the Uewang and Kuribrong Rivers, as well as the Potaro River itself on the west, to the source of the Kwitaro River; thence down the midstream of the Kwitaro River through its mouth to the mid-stream of the Potaro River; then down the mid-stream of the Potaro River for about six decimal seven five (6.75) miles or (10.86) kilometers; thence in a southeasterly direction along the watershed between the Echerak and Amakwa rivers, right bank Potaro River; thence northwards along the watershed between the Potaro River and its right bank tributary, the Amu River, to the source of the Waraparu Creek, thence down the mid-stream of the Waraparu Creek through its mouth to the mid-stream of the Potaro River; thence down the mid-stream of the Potaro River to a point opposite the mouth of the Haiabaru Creek, thence to the point of commencement; containing an area of two hundred and forty two (242) square miles, or six hundred and twenty-six decimal eight (626.8) square kilometers approximately."

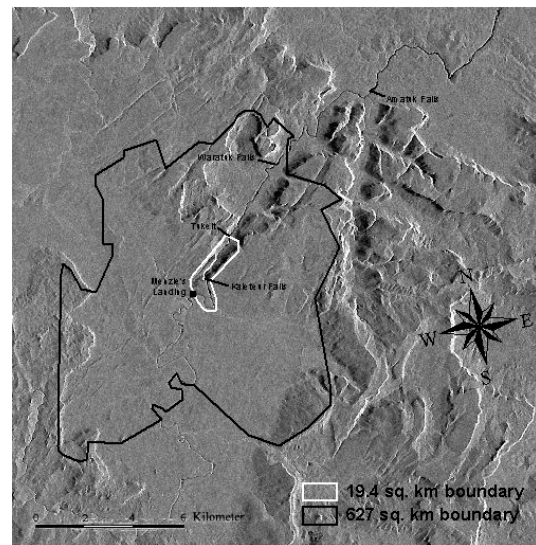


Figure 4: Radar image of the Potaro Plateau provides an aerial view of the topography of the region. Areas indicate the size of the 1973 (19.4 sq. km) and 1999 (627 sq. km) boundaries of Kaieteur National Park.

Legal Status, Administration and Management

In 1973, the Kaieteur National Park Act was passed followed by the National Parks

Commission Act (NPCA) in 1977. The NPCA gave management authority to the National Parks Commission (NPC), an independent agency (World Wildlife Fund, 1991), responsible for all regional and national parks. As an independent agency, the NPC has been variously required, over the years, to report to either the Ministry of Communication and Works; Guyana Agency for Health Sciences, Education, Environment and Food Policy (GAHEF); the Ministry of Health; or the Ministry of Culture, Youth and Sports. In 1995, a Kaieteur Board was established through the Office of the President. This board meets independently of NPC on issues dealing with Kaieteur. The NPC continues to collect the landing fees required of all aircraft using the Kaieteur airstrip and is responsible for paying the rangers and park wardens stationed at the park. Along with the NPC and the Kaieteur Board, Kaieteur now comes under the administration of the Office of the President. In the past, management of the park has been minimal, at best. Guyana is currently in the process of establishing a single centralized agency to oversee and manage Kaieteur. Until this is done, it will be difficult for Guyana to develop and carry out any kind of a comprehensive management plan.

Infrastructure

Since the World Wildlife Fund's first major attempt to develop a management plan of Kaieteur in 1991 at the request of the Guyana Ministry of Trade and Tourism, little has been done to address the infrastructure problem at Kaieteur. Most of the current infrastructure is located in the immediate vicinity of the falls. Kaieteur has two airstrips, a small dirt airstrip that is no longer in use and the main 610 m airstrip. The larger airstrip was paved with concrete in 1993 and is capable of handling up to an Islander aircraft (eight-seater). One hundred ten meters from the head of the airstrip there stands a large "benab" or hut to shelter visitors from the sun and rain and a small shed with two non-functional toilets. There are three main buildings at Kaieteur. The larger building, closest to the falls, was built in the 1980's. It has two bedrooms, inadequate kitchen and sanitary facilities, a leaky roof, broken windows and no lights. This building is considered the "guesthouse". A smaller wooden house just

behind the guesthouse has little to no facilities. This is where the park wardens have lived. Two other buildings in the vicinity of the falls are the radio beacon house just south of the runway and a small recently replaced house for the attendants of the meteorological station.

Along the edge of the gorge, about 150 meters from the falls, stand the cement footings of another structure that once overlooked the falls. In the 1920's the British built a small house upon these cement footings to serve as the original guesthouse. The outhouse stood several yards away near the edge of the gorge with a large bucket serving as the base of the seat. Although the guest- and out- houses eventually fell, the bucket and footings of this historical site still remain.

Menzie's Landing is located approximately one mile upstream from the falls. It has always been a way station for gold and diamond miners (locally known as porkknockers) heading into the bush or waiting for a flight to Georgetown. Although considered outside of the 19.4 square km boundary of the park, the Official Gazette (Department of Lands and Surveys, 1961) included Menzie's Landing as part of the park. Today, Menzie's Landing has several wooden buildings and an active shop where miners can restock supplies, sell their gold and diamonds, or have a drink (mostly "High Wine," a cheap form of rum). Although generally quiet, Menzie's Landing can be quite rough when there is a large influx of miners passing through.

Approximately seven kilometers below Kaieteur Falls, on the Potaro River, is Tukeit. Historically, Tukeit had several small structures which were built by the British around the 1950's. The buildings housed a kitchen/dining area, sleeping quarters with bunks, and a bathhouse with its row of toilets. It was a resting place for those visitors who selected to hike the steep old Amerindian trail (believed to be 1000 years old) along the Korume Creek gorge to and from the Kaieteur Falls. Today, Tukeit stands as a mute reminder of the days of tourism under British rule. What remains are a few boards, a pile of rusting equipment and some broken toilets.

Local Communities

The only permanent settlement near Kaieteur is the Amerindian village of Chenapau. It is approximately 25 km upstream from the falls and has a population of 317 (Ministry of Amerindian Affairs, no date). The people belong to the Patamona tribe and have a traditional lifestyle of hunting, fishing, subsistence agriculture, and collection of minor forest products. Chenapau has also become a center of mining activities for gold and diamonds by both the Amerindians and non-Amerindians.

Access to Kaieteur

There are two modes of transportation to Kaieteur, by air-charter or by boat up the Potaro River. The most popular way to Kaieteur from Georgetown is by air. Kaieteur can be reached by a 1.5 hour flight in a small plane which flies up the Potaro River gorge for a spectacular aerial view of the falls. Depending on the pilot, the plane may circle overhead to provide photo opportunities to the guests on board. The drawbacks to air charters are that they tend to be costly and limit visitors to 1 – 2 hours at the falls. The other option is a 3 – 4 day trek overland, which requires a sturdy pair of walking boots. The traveler must carry all gear and food needed for the trip. The overland trip begins with a rough truck from Georgetown to Pamela Landing near Madia on the Potaro River. From the landing a boat takes the traveler upstream including a portage around Amatuk and Waratuk Falls (carrying boat and gear overland to the other side of the falls) before arriving at Tukeit. Here they can set up camp and rest before beginning the ascent up the Korume Creek gorge on the old Amerindian trail to Kaieteur. The hike up the gorge takes an average of 2-3 hours, depending on a person's physical condition. Travel overland on foot from Amatuk to Kaieteur may not be feasible at present because of the degradation of the trail by mining activities and overgrowth.

BIODIVERSITY OF THE PARK

Biological Diversity

Science is only beginning to understand the diversity of plants and animals found in

Guyana, and compares to other protected areas little is known about Kaieteur (Table 1). Plant and animal data need to be collected before important questions can be answered about taxa present in the area, their distribution, population dynamics, and endemism. Some may question the need for detailed collecting in the Kaieteur area, but collections build vouchered inventories that, in turn, provide accurate information for verifiable environmental assessments, biodiversity conservation, and development projects (Bojorquez-Tapia *et al.*, 1994). From the foundation of inventories, guides and checklists can be produced (Mori *et al.*, 1998). The Preliminary Checklist of the Plants of Kaieteur National Park (Kelloff and Funk, 1998), the floristic comparison between the forests at Kaieteur and Kwakwani, Guyana and Barro Colorado Island, Panama (Kelloff, ms.), and the distribution and broad floral affinities of plants of the Potaro Plateau (Kelloff and Funk, in review) represent the first serious attempts to understand the plant diversity at Kaieteur. However, the checklist of vascular plants (the best known floral group of the area), the preliminary checklists of the lichenized fungi and bryophytes (Appendix B) and the two ecological plots established at Kaieteur are only the beginning of the environmental information necessary for any valuable protected area's management.

The Potaro Plateau supports many different habitats. The "guiana type" savanna is characterized by a shrub-herb plant community with only very few small trees. The pink sands support scattered shrubs and a dense mat of small herbaceous plants. During the wet season, on the almost bare, flat sandstone, numerous species of lichens (*Cladonia spp.* and *Cladina spp.*), the small blue flowered herb *Burmanna bicolor*, two types of carnivorous plants, the tiny terrestrial bladderworts (*Utricularia spp.*), and the red sundew (*Drosera kaieteurensis*), spring up out of tiny cracks and on the surface of the rock. This habitat is also the home of a species of small frog (*Leptodactylus rugosus*). During the brief rainy season, its tadpoles can be seen swimming through the thin sheet of water on the bare rocks.

Table 1 : Current knowledge of the flora and fauna within the 1970's boundary (19.4 square km) at Kaieteur National Park as compared to what is known for Guyana. Information in brackets indicates the theoretical percentage of species represented based on the current knowledge of the taxa in the Neotropics.

Floral and Faunal Groups	No. of species: Guyana	No. of species: Kaieteur
Lichenized fungi (lichens)	337 (90%) ¹	87 (low) ²
Bryophytes (mosses)	238 (low) ¹	72 (low) ³
Anthocerophyte (hornworts)	1 (?) ¹	Unknown
Hepatics (liverworts)	259 (low) ¹	4 (low) ¹
Gymnosperms	5 (low) ¹	Unknown
Ferns	523 (90%) ⁴	115 ⁵
Flowering plants (seed)	6334 (90%) ⁴	1176 ⁵
Reptiles and Amphibians	254 (70%) ⁶	29 (low) ⁷
Fish (freshwater)	673 (low) ⁸	180 (low) ⁸
Butterflies and moths	ca. 12,000 (50%) ⁹	164 (low) ¹⁰
Termites	130 (90%) ¹¹	22 (low) ¹²
Mammals	227 (95%) ¹³	151 (65%) ¹⁴
Birds	786 (90%) ¹⁵	180 (60%) ¹⁶

1. T. Hollowell (pers. comm.) Biological Diversity of the Guianas database; 2. P. Depriest (pers. comm.) unpublished data; 3. A. Newton (pers. comm.) unpublished data; 4. Boggan *et al.*, 1997; 5. Kelloff and Funk, 1998; 6. based on current knowledge of neotropical herpetofauna; 7. based on museum specimens; 8. L. Page (pers. comm.); 9. L. Page (pers. comm.); 10. based on field observations and collections, S. Fratello (pers. comm.); 11. P. Eggleton and M. Kane (pers. comm.); 12. Eggleton *et al.*, 1999; 13. Engstrom and Lim, 2002, Lim and Engstrom, in prep., Lehman, 2002; 14. based on Lim and Engstrom, in prep.; Emmons, 1997; 15. Braun *et al.*, 2000; 16. based on field observations.

Brocchinia micrantha, one of the largest of all bromeliads growing to the height of 3-3.5 meters, takes advantage of humus caught in larger cracks and crevices. The water that collects in the base, 'tank', of *B. micrantha* leaves provides a home for an assortment of animals (e.g., the golden frog, *Colostethus beebei*, endemic to Guyana) and plants. One such plant is the largest of the bladderworts, *Utricularia humboldtii*. Tiny bladders on its aquatic roots capture insects that live in the stagnant waters and digest them to obtain nutrients. From the bromeliad tank, the inflorescence of *U. humboldtii*, with its light purple flowers, can reach the height of 1.8 meters.

Another species of *Brocchinia*, *B. reducta*, with tall, narrow, yellowish leaves, grows on the grass savanna and on the lower limbs of trees. First collected and described from Kaieteur Falls, this species was thought to be endemic to the area until it was later collected in Venezuela (Soderstrom, 1963).

Small trees such as *Andira grandistipula* and shrubs like *Clusia* and *Erythroxylum* can develop into "bush islands" which support an entire community of plants and often differ from island to island. Orchids, ferns and bromeliads are frequently observed both on the ground and on other plants. The cabbage head bromeliad, *Aechmea brassicoides*, is a common plant of the bush islands. This bromeliad is so named for the habit of its inner leaves being folded into a cabbage-like head. It can be found on the ground and up on the trees that make up the small bush islands on the savanna, and it is endemic to Kaieteur.

The bright yellow flowers of the "yellow-eyed grass" (Xyridaceae) are seen everywhere on the savanna. If one looks closely upon some of these flowering heads, a yellow fungus can be found. It is believed that the fungus mimics the flower and may be dispersed by flying insects landing on the flowers. Other small herbs found in the savanna on moist sand are members of Eriocaulaceae family, "Bog Buttons". These

small white flowers resemble a tuft of cotton on a pin.

The white sand forests along the rivers are composed of numerous tree species, including wallaba (*Eperua*), aromata (*Clathrotropis macrocarpa*), kakaralli (*Eschweilera* spp., Lecythidaceae) and members of the coffee family (Rubiaceae). The understory of these forests support *Heliconia*, Marantaceae, and many species of Melastomataceae.

Because of the cool mist that rises up from the gorge, a cloud forest habitat is found along the top of the gorge just downstream from the falls. This riparian forest supports more epiphytes than a typical rain forest, with tree branches covered with mosses, orchids, ferns and aroids. Down in the gorge near the splash basin, the vegetation is bathed in a continuous fine mist from the falls. The cool, ambient air creates a unique habitat that scientists are just beginning to understand. Collecting in this area has been difficult. The steep cliff face and the slippery rocks make it almost impossible to get near the falls when the volume of the Potaro River is high. A small fern, *Grammitis mollissima*, grows on moss-laden rocks and tree trunks, and bromeliads line the steep walls of the gorge. A primitive species of bromeliad, *Navia sandwithii*, is found in the moist, shaded areas between boulders. Found growing only in the splash basin habitat are two species of *Rhoogeton* (Gesneriaceae). This red-flowered member of the African violet family has been reported near Mt. Roraima in a similar habitat (Toogood, 1983).

There are 22 endemic species currently recorded for Kaieteur National Park (Table 2). In Rapateaceae, a family centered on the Guiana Shield, nine species can be found near the falls including *Potarophytum riparium*, a monospecific genus endemic to Kaieteur (Maguire, 1970).

Biological Exploration

The first European to see Kaieteur Falls was a British surveyor, C. Barrington Brown, in 1870. Since that time, the Kaieteur area has been explored by a number of botanical collectors including G.S. Jenman (1881 and

1898), E.F. Im Thurn (1879-99), T.G. Tutin (1933), N.Y. Sandwith (1937), D.B. Fanshawe (1944), B. Maguire and D.B. Fanshawe (1955), and R. Cowan and T. Soderstrom (1962). Recent collectors from the Smithsonian's Biological Diversity of the Guianas (BDG) Program and the University of Guyana (UG) include L. Gillespie (BDG), D. Gopaul (UG), T. Henkel (BDG), C.L. Kelloff (BDG), L.P. Kvist (BDG), H. Lall Persaud (UG), J.J. Pipoly (BDG), and S. Tiwari (UG).

There have been numerous species of ferns and flowering plants discovered in Guyana that are new to science. George S. Jenman, Government Botanist from 1879 to 1901 (Ek, 1990) described many new species. The Cambridge University Expedition of 1933 collected many new taxa (Tutin, 1934a; Tutin, 1934b; Lindeman and Mori, 1989; Ek, 1990). Maguire and Fanshawe's expedition (Maguire and collaborators, 1948) to Kaieteur as well as Cowan and Soderstrom's expedition produced a number of new taxa from the Potaro Plateau. Kaieteur is still yielding new species. While inventorying the trees of the Korume Creek gorge, a tiny fern less than 2 cm tall, *Hecistopteris kaieteurensis* (Vittariaceae), was discovered growing in moss on a trunk of a tree (Kelloff and McKee, 1998).

Even less is known about the animal species of the Potaro Plateau. A preliminary checklist of the birds of Kaieteur was compiled using observation data from several ornithologists who visited the park between the years 1991 – 2002. Although thorough faunal inventories of the park are yet to be initiated, lists of the butterflies, moths, and termites (Appendix C) and birds, mammals, and herpetofauna (Appendix D) are being compiled from the literature and collection data. These preliminary faunal lists provide a basis from which future collections and inventories can be planned. Preliminary studies from recent visits by specialists including G. Bourne (University of Missouri – St. Louis), S. Lehman (Smithsonian Institution), R. Reynolds (U.S. Geological Survey), M. Tamessar (University of Guyana), and D. Wilson (Smithsonian Institution) have indicated that this area is particularly rich in animal life, and that the

Table 2: Plants species endemic the original 19.4 square km of Kaieteur National Park, Guyana.

PLANT ENDEMICS	
Aquifoliaceae	
	<i>Ilex soderstromii</i> var. <i>soderstromii</i>
	<i>Ilex soderstromii</i> var. <i>ovata</i>
Bromeliaceae	
	<i>Aechmea brassicoides</i>
Chrysobalanaceae	
	<i>Couepia cognata</i>
Fabaceae – Caesalpinioideae	
	<i>Dicymbe jenmanii</i>
	<i>Macrolobium huberianum</i> var. <i>pubirachis</i>
	<i>Swartzia eriocarpa</i>
	<i>Swartzia lamellata</i> var. <i>kaieteurensis</i>
	<i>Tachigali pubiflora</i>
Fabaceae – Papilionoideae	
	<i>Clitoria kaieteurensis</i>
Melastomataceae	
	<i>Graffenrieda irwinii</i>
	<i>Miconia maguirei</i>
Myricaceae	
	<i>Myrcia extranea</i>
Myrtaceae	
	<i>Marlierea buxifolia</i>
Poaceae	
	<i>Thrasya achlysophila</i>
	<i>Paspalum bifidifolium</i>
Podostemaceae	
	<i>Jenmaniella guianensis</i>
	<i>Jenmaniella isoetifolia</i>
	<i>Rhyncholacis jenmanii</i> f. <i>dolichophylla</i>
Rapateaceae	
	<i>Potarophytum riparium</i>
Rubiaceae	
	<i>Psychotria kaieteurensis</i>
Sapotaceae	
	<i>Pouteria kaieteurensis</i>

presence of previously unidentified species is probable. Historically, agouti (*Dasyprocta*), paca (*Agouti paca*), tapir (*Tapirus*), red brocket deer (*Mazama americana*), collared peccary (*Tayassu tajacu*), jaguarundi (*Herpailurus*), raccoon (*Procyon*), bushmaster (*Lachesis stenophrys*), labaria (*Bothrops spp.*), and tegu or salemperter (*Tupinabis nigropunctatus*) have been recorded for this area. Although the fauna inventories for the area are incomplete, there are

a number of animals considered under CITES to be extremely rare (in a broad geographic range). Important species known to be in the area are the bird Cock-of-the-Rock (*Rupicola rupicola*), as well as bush dogs (*Speothos venaticus*, CITES-extremely rare). A pair of hyacinth macaws (*Anodorhynchus hyacinthinus*, CITES-extremely rare) were seen flying over Kaieteur (author's field notes, Kelloff, 1993-1995) in July 1994. Although not officially reported for Guyana, it would be interesting to investigate the possibility of a pair nesting in the area.

The cave behind the falls is home to three species of swifts: the white-chinned swift, *Cypseloides cryptus* (globally rare), which has a colony of several thousand birds; the white-tipped swift, *Aeronautes montivagus* (found only at Kaieteur and the Kanuku Mountains); and the large white-collared swift, *Streptoprogne zonaris* (Michael Braun, pers. comm.). These birds can be seen circling above the falls in the early morning and at dusk.

Producing maps

There are no published studies of the ecological systems or natural habitats of Kaieteur. These types of studies are needed in order to base decisions on where critical areas for preservation might be located. What has been published from various expeditions and inventories are primarily in the form of checklists with relatively no other information. However, when these lists are combined with specimen label data, they can provide valuable information concerning the distribution and ranges of species (Yahnke *et al.*, 1998). At present, the plants are the best-known group of organisms of Kaieteur. Since the area most affected by ecotourism is centered in the 19.4 square km portion of the park, this area will be used to demonstrate species distribution maps.

A database of the plants of Kaieteur has been compiled using current and historical plant collections from the U.S. National Museum (US), New York Botanical Garden (NY), British Museum (BM), Royal Botanic Gardens – Kew (K), the University of Utrecht (U), and from the literature. The database is specimen based and contains information on collector(s), collection number, taxa, locality, and other important data. Each record has been verified and, if the latitude

and longitude (georeference) are missing, they have been added using either a reading from a global positioning system (GPS) taken at collection locations at Kaieteur or from 1:50,000 topographic maps. Large tables and lists of raw data can be overwhelming to the user, presenting a hindrance to meaningful interpretation of the information. Maps are useful tools for consolidating large amounts of environmental information into a visual format that can be understood by most users. They provide a quick reference for collection localities of particular species. Mapping the patterns of species occurrences can help in the analysis of species richness and diversity (Stoms, 1994) and indicate areas that require further study. Although this database is far from a comprehensive catalogue of the distribution of plants at Kaieteur, it is a beginning.

Compilation and digitization of spatial features of Kaieteur National Park has been performed in Guyana through collaborations with the Natural Resources Management Project (NRMP) and the Centre for the Study of Biological Diversity (CSBD) at the University of Guyana. The expanded Kaieteur National Park is covered by four topographic maps (Survey Department-Guyana, 1970, 1:50,000 scale; UTM projection, zone 21.): the NE and SE of sheets of the Ayanganna quadrangle and NW and SW sheets of the Kaieteur quadrangle. The topographic contours were digitized in increments of 50 feet.

ArcView was used to integrate information from the database with the digitized map of the Kaieteur area to produce a distribution or dot map (Figure 5) of collection localities. From the mapped collection data, it is apparent that plant collecting on the Potaro Plateau has generally focused within the vicinity of the falls and along the banks of the Potaro River. This type of map is useful in providing a graphic representation of the general area where plants have been collected and suggesting where more collecting and study needs to be done. What this simple map does not indicate is what was collected or the intensity of collection for a particular locality. Distribution maps of individual plant species can provide some

information on the location where important species, *i.e.*: rare or endemic, have been found. This information can be useful when developing a park for ecotourism and conservation. Since it is impossible in the context of this paper to produce a range map of every species found in the park, this section will focus on the 22 taxa endemic to Kaieteur. Five area maps have been produced of Kaieteur National Park between the area of Menzie's Landing and just below Tukeit. Each map displays the general area where plants endemic to the park have been collected (Table 3).

Table 3: Known collection points for the endemic plants of Kaieteur National Park illustrated on maps with reference to figure numbers.

COLLECTION LOCALITIES OF PLANT ENDEMICS

Figure 6

- *Thrasya achlysophila*
- *Tachigalia pubiflora*
- *Psychotria kaieteurensis*
- *Pouteria kaieteurensis*
- *Potarophytum riparium*

Figure 7

- *Swartzia eriocarpa*
- *Myrcia extranea*
- *Miconia maguirei*
- *Macrobium huberianum* var. *pubirachis*

Figure 8

- *Marlierea buxifolia*
- *Jenmaniella isoetifolia*
- *Swartzia lamellata* var. *kaieteurensis*
- *Ilex soderstromii* var. *soderstromii*

Figure 9

- *Graffenrieda irwinii*
- *Couepia cognata*
- *Ilex soderstromii* var. *ovata*
- *Aechmea brassicoides*
- *Rhyncholacis jenmanii* f. *dolichophylla*

Figure 10

- *Licania microphylla*
 - *Dicymbe jenmanii*
 - *Clitoria kaieteurensis*
 - *Jenmaniella guianensis*
-

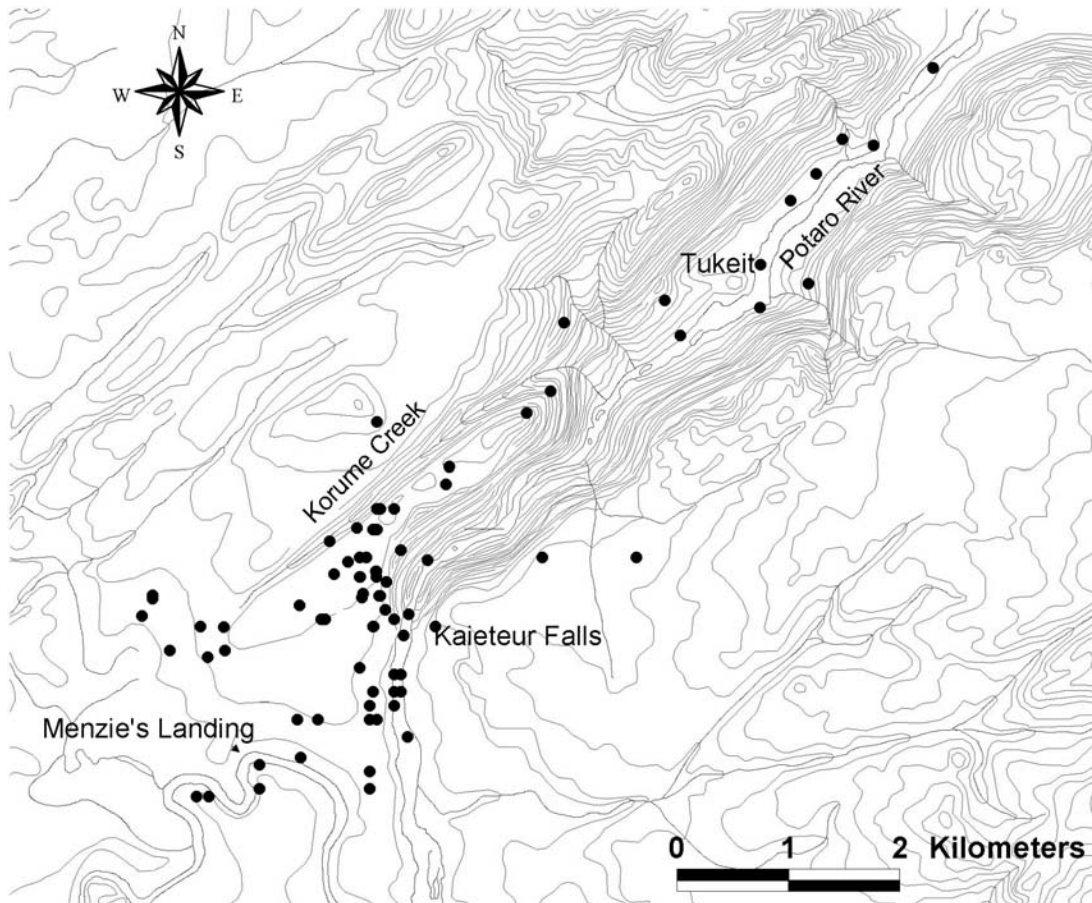


Figure 5: Plant collection data, georeferenced and represented by dots (•), have been plotted on the topographic map of Potaro Plateau. Most plants collected in Kaieteur National Park have been in the proximity of the falls and along the Potaro River.

When developing the park for ecotourism, the plants that must be considered first and foremost are the endemics. These plants have a range that is restricted to the park within the immediate vicinity of the falls and are the most vulnerable. From collection localities and site surveys (*i.e.*, ground-truthing), the habitats can then be assessed to determine whether protection from foot traffic or park infrastructure development should be considered in the management plan. An example of a well-meaning decision leading to the destruction of some of vulnerable habitat can be seen with the clearing of the bush from the north end of the airstrip. Whether this was done to avoid any perceived interference with air traffic is unknown. It is known that the slashing of these bush islands damaged not only the general habitat, but also the endemic bromeliad,

Aechmea brassicoides, as well as other plants, including orchids, that occupy this habitat. This damage could have been avoided, or at least minimized, if a maintenance plan had been in place for this area.

The area at the north end of the airstrip is one of the main trails visited by tourists. Slashing the plants of the bush islands and leaving the vegetation to rot also detracts from the natural beauty that attracts so many tourists to Kaieteur. The bush islands are an important component of habitat in this area, and they could be included as a scenic point along a self guided tour of the park (to be discussed later). The cabbage head bromeliad, *A. brassicoides*, easily distinguished by the habit of its inner leaves, is another “point of interest” that can bring awareness to the importance of preserving these

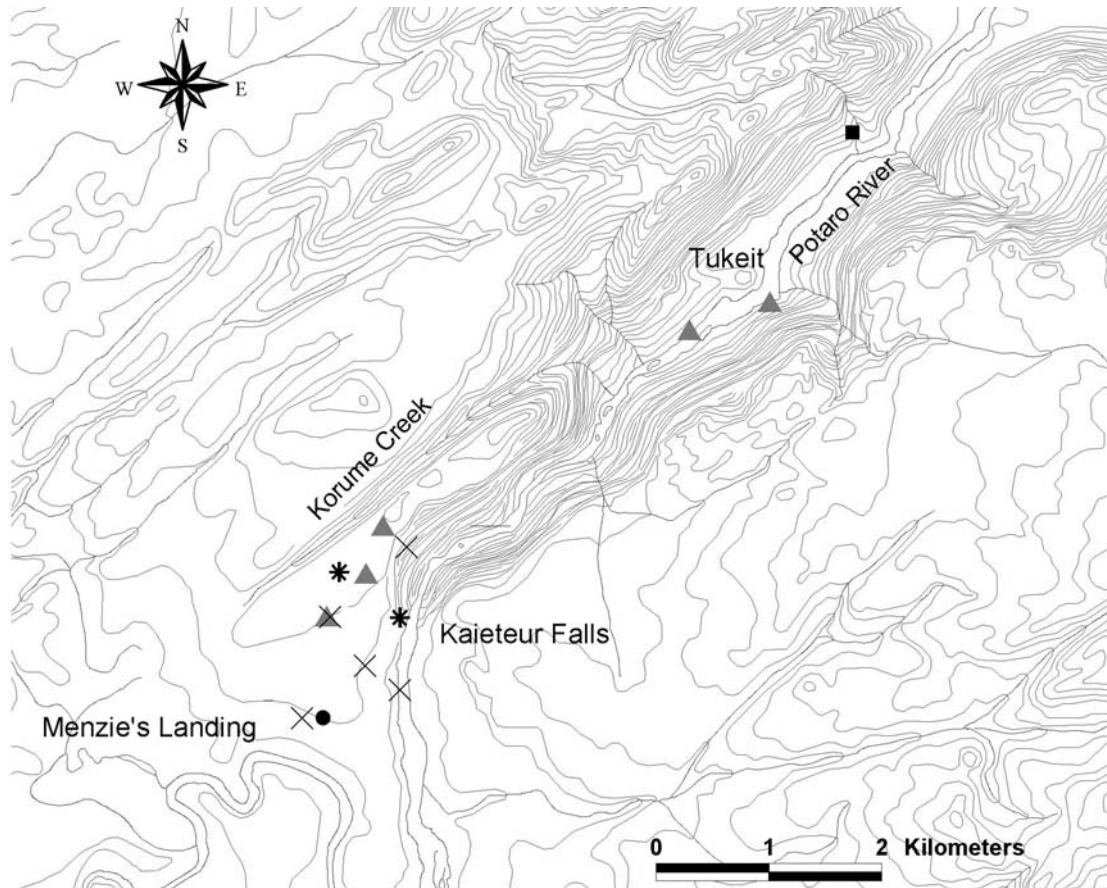


Figure 6: Area map of Kaieteur National Park between Menzie's Landing and Tukeit showing collection points for the following plants endemic to the park: *Thrasya achlysophila*, Poaceae (●); *Tachigalia pubiflora*, Fabaceae-Caesalpinoideae (■); *Psychotria kaieteurensis*, Rubiaceae (▲); *Pouteria kaieteurensis*, Sapotaceae (*) and *Potarophytum riparium*, Rapateaceae (×).

fragile habitats. Understanding the plant community at Kaieteur and the species distribution is an important first step in developing a comprehensive management plan for the park.

PARK DEVELOPMENT

In most countries, the nation's protected area system is the responsibility of the government. The land set aside for parks and reserves represents a significant portion of the national territory. However, funding and administration for protected areas tends to rank low in priority within a government's budget and as a result the efficiency of any management policy is reduced (Barzetti, 1993).

There have been several papers written on the development of a management strategy for Kaieteur (MacKnight, 1991; Schuerholz, 1992; Lechner, 1997; World Bank, 1998). Most of these papers focus on a large-scale development project for the park and involves a huge capital investment. Although these papers provide excellent suggestions on how Kaieteur National Park can be developed, they would require a tremendous amount of person hours to implement, and they assume that a management plan or set of guiding principles are already in place. Guyana is just beginning to articulate its position on biodiversity. The National Biodiversity Action Plan (EPA-GEF/UNDP, 1999) and the National Protected Area System (World Bank, 1996) recognize biodiversity as an

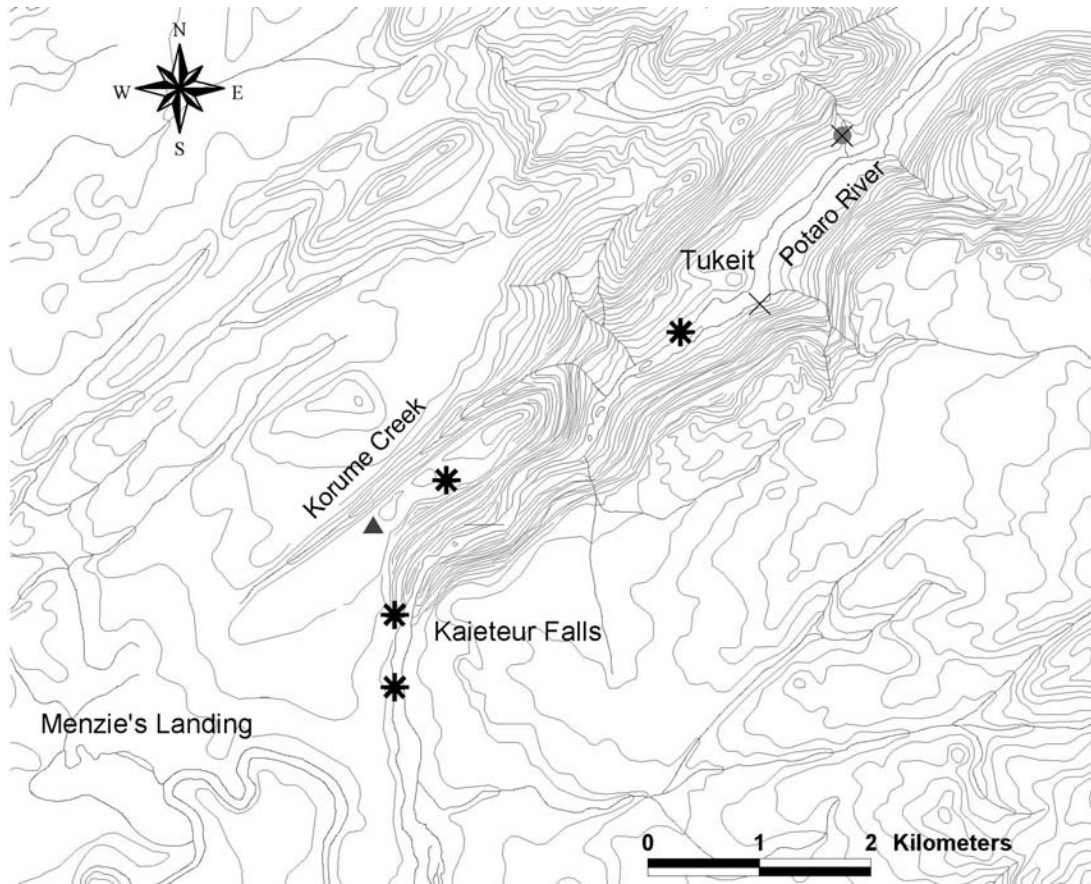


Figure 7: Area map of Kaieteur National Park between Menzie's Landing and Tukeit showing collection points for the following plants endemic to the park: *Swartzia eriocarpa*, Fabaceae-Caesalpinoideae (●); *Myrcia extranea*, Myrtaceae (▲); *Miconia maguirei*, Melastomataceae (*) and *Macrolobium huberianum* var. *pubirachis*, Fabaceae-Caesalpinoideae (X).

important national asset that can offer Guyana economic options, but the manpower and funding will have to come from a variety of sources.

There are various options that can be pursued for the development of Kaieteur National Park based on the current use of the park, local community involvement, biological diversity, and habitat. Beginning with the area around the falls, the trail to and including Tukeit can be developed for tourism-for-nature.

Tourism-for-Nature

Tourism is becoming one of the fastest growing industries in the world. The world population is taking part in more tourism activities than a decade ago. Between 1950 and 1999, the number of international arrivals

jumped from 25 million to 664 million, and the numbers are still rising (World Tourism Organization, 2000). In 2000, the number of tourists traveling rose to a record high of 698 million with an estimated US\$476 billion spent (World Tourism Organization, 2001). Traveling abroad is not limited to special events such as the Olympics or the Soccer World Cup, many people are traveling for the sole purpose of enjoying and studying nature. Nature tourism, or ecotourism, is the fastest-growing sector of the tourism industry. Humans derive satisfaction and inspiration from observing the wonders of nature (Iltis, 1997), whether it is a geological formation, a landscape, or wildlife.

Protecting land in a pristine state in order to promote ecotourism has the potential to generate income. It also provides an additional

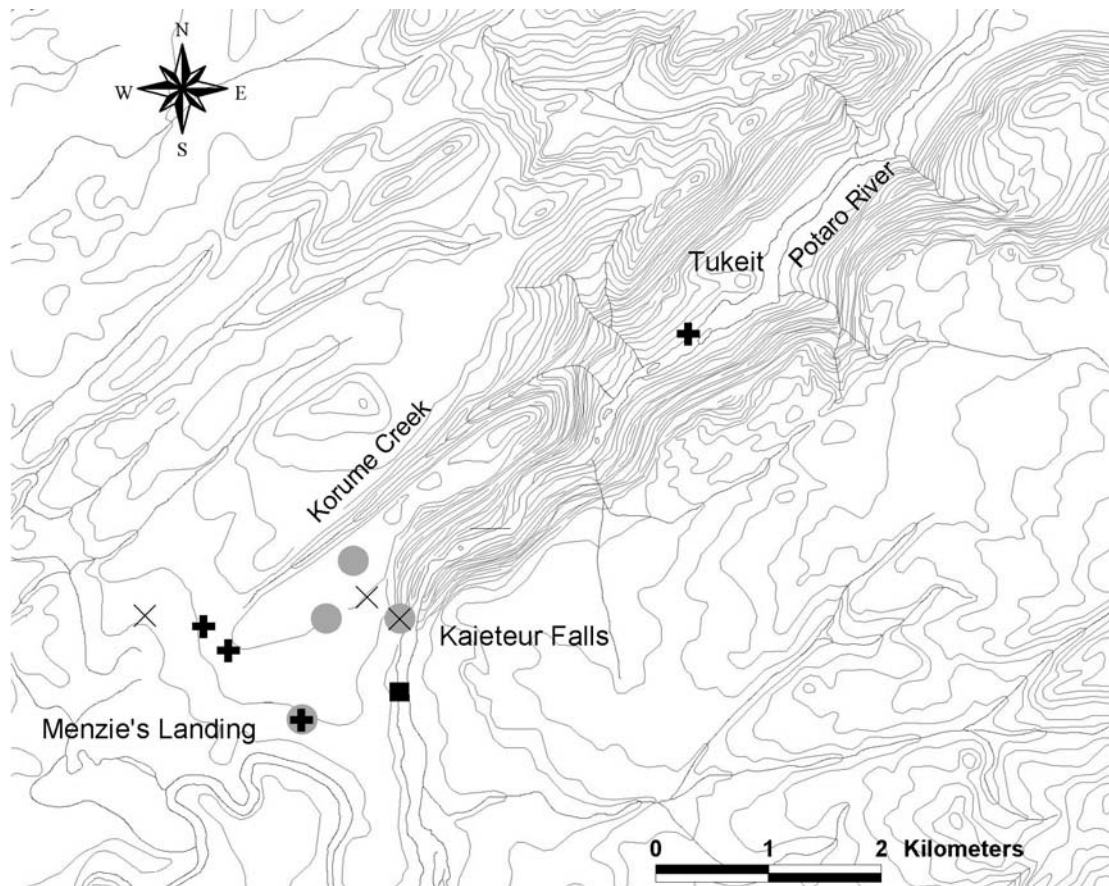


Figure 8: *Marlierea buxifolia*, Myrtaceae (●); *Jenmaniella isoetifolia*, Podostemaceae (■); *Swartzia lamellate* var. *kaieteurensis*, Fabaceae-Caesalpinoideae (+) and *Ilex soderstromii* var. *soderstromii*, Aquifoliaceae (X).

justification for setting aside land for conservation. Observing birds in their natural habitats is one of the leading sources of ecotourism and prime example of how tourism can lead to conservation. For instance, in Costa Rica the quetzal (*Pharomachrus mocinno*) is the most sought after bird by birdwatchers. Its breeding grounds are located in the Monteverde Cloud Forest and the International Children's Forest, where they are protected. However, during certain times of the year the quetzal migrates to the lowlands to feed on fruits of the Lauraceae (Wille, 1993; Powell and Bjork, 1994; Powell and Bjork, 1995). In order to protect this bird species, lowland forests, and cloud forests must both be conserved. The profits from ecotourism have been used to set aside and preserve the habitats used by the quetzal, thus contributing to the survival of the

species and all other plants and animals associated with this bird. It also preserves future income from birders for the local and national economies (Mori *et al.*, 1998).

Kaieteur is no exception to these principles. In addition to the waterfall, the spectacular bird life attracts some visitors but has the potential to bring in many more. Scarlet macaws frequent this area. Gliding through the gorge, they are frequently seen flying close to the edge of the escarpment. The Cock-of-the-Rock can be found in the area considered its home range near Johnson's view. It is here, on the forest floor, that bright orange males perform their courtship display to attract potential female partners. At the waterfall there are large numbers of swifts that roost on the canyon wall behind the falls. It is quite a sight to witness hundreds, if not thousands, of birds darting in

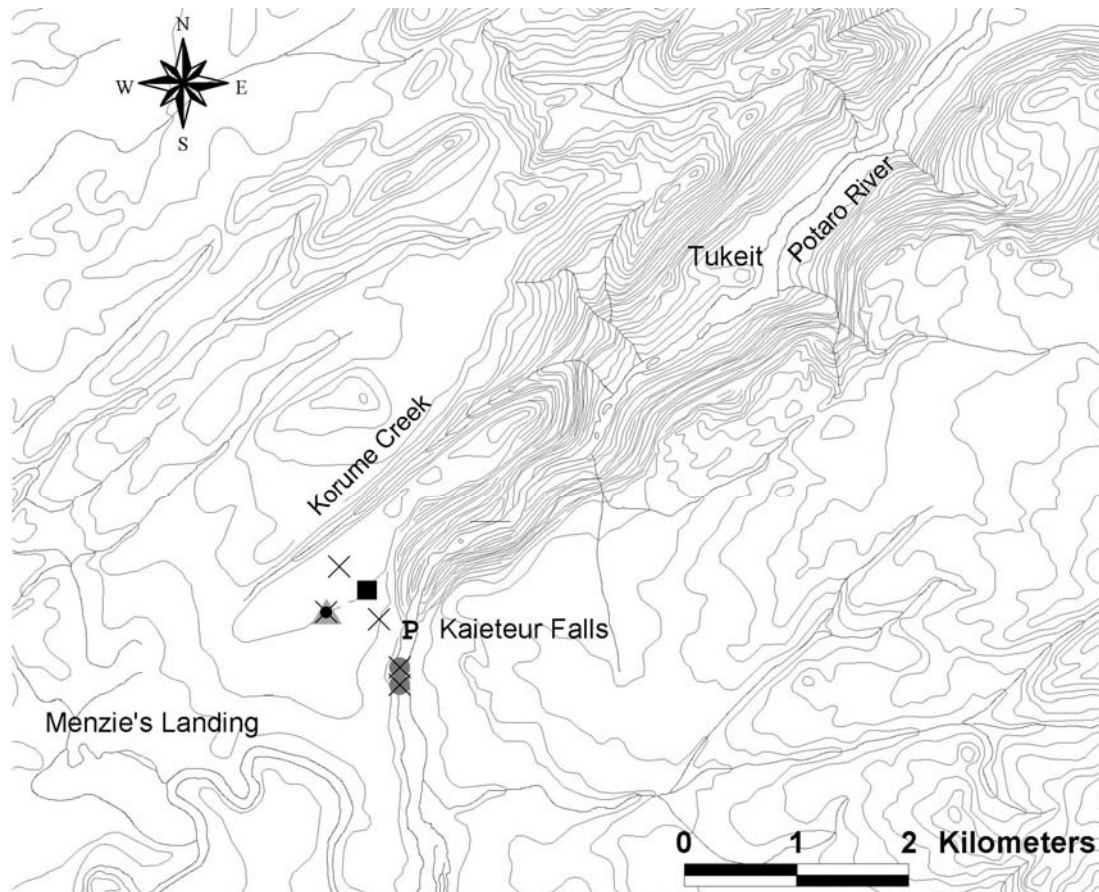


Figure 9: Area map of Kaieteur National Park between Menzie's Landing and Tukeit showing collection points for the following plants endemic to the park: *Graffenrieda irwinii*, Melastomataceae (●); *Couepia cognata*, Chrysobalanaceae (▲); *Ilex soderstromii* var. *ovata*, Aquifoliaceae (■); *Aechmea brassicoides*, Bromeliaceae (×) and *Rhyncholacis jenmanii* f. *dolichophylla*, Podostemaceae (P).

and out of the thin edges of the waterfall at dawn and dusk each day. In addition to these birds, excellent birdwatching can be realized in the forest on the way to Tukeit.

Involving local communities

Many early studies of development and management strategies for protected areas have proposed a "top-down" approach. This approach advocates high levels of technical and capital inputs with an external control over resources. Local communities are generally left out of such development plans or have very little input.

In recent years, it has been acknowledged that more emphasis is needed on contributions of local communities in the development and

management process, with an increased emphasis on socio-economic and cultural factors. In a draft decision on tourism submitted to the United Nation's Commission on Sustainable Development, Hanif (1999) urged governments to consult local communities and major stakeholders in the tourism development process "including policy formulation, planning, management and sharing of benefits". He cautioned that without involving local communities and major stakeholders in the development process, ecotourism would be detrimental to the harmonious relationship among the people, the community and the environment.

An example of where the establishment of a park caused hardship in surrounding communities can be seen in the case of the

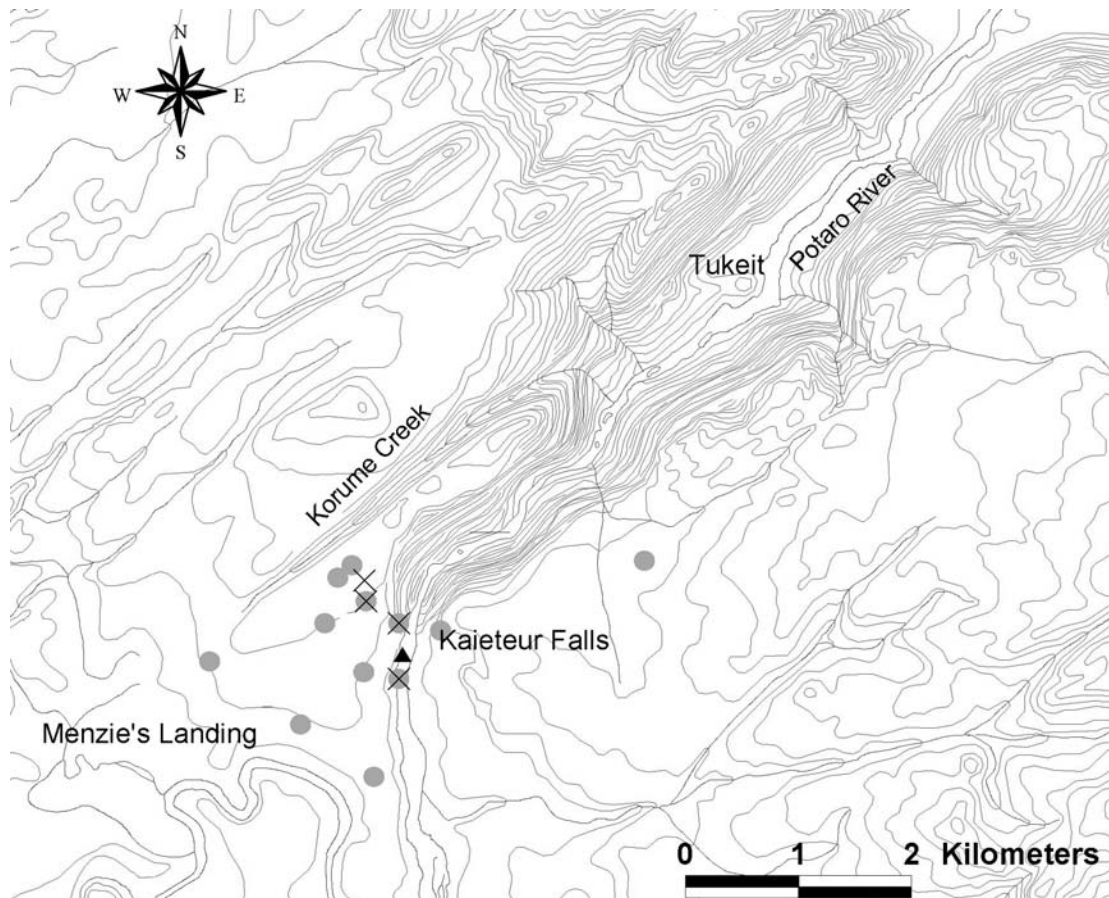


Figure 10: Area map of Kaieteur National Park between Menzie's Landing and Tukeit showing collection points for the following plants endemic to the park: *Dicymbe jenmanii*, Fabaceae – Caesalpinoideae (•); *Clitoria kaieteurensis*, Fabaceae – Papilionoideae (X); *Jenmaniella guianensis*, Podostemataceae (▲) and *Licania microphylla*, Chrysobalanaceae (no georeference, not illustrated on map).

Keoladeo National Park in India. In 1982, India declared Keoladeo a national park. The local communities were not brought into the decision-making process, and as a result officials were not aware of potential problems that could arise out of limiting access to the park. The establishment of the park deprived one local community of the rights to graze their cattle or to gather grass for thatching. Another community was denied its main route to market. This brought on civil unrest and several people died. Today, the local communities are still paying the price in lost resources because their needs were not taken into consideration when the area was converted into a conservation area (Department for International Development,

2001). The park also suffers from poachers and other encroachments.

At Kaieteur, the indigenous community closest to the park is Chenapau. The Patamona Amerindians at Chenapau and other surrounding communities have had long-term occupation of this area on the Potaro Plateau. The residents practice traditional subsistence activities are slash and burn agriculture, hunting, and fishing as well as small-scale mining. When the Chenapau community learned of the March 1999 order expanding Kaieteur National Park to its present 627 square km without any meaningful consultation with the Patamona people of the Potaro Plateau, they immediately protested to the Government. The general reluctance of the government to deal with

indigenous peoples, has set the first stage in the development of the NPAS project into abeyance (Richards, 1999; Colchester, 2001).

In many countries indigenous people view tourism as an activity coming from outside with no benefits to the community at large, or when their communities are included in the tours, they may feel they are being exploited. This was true in the Quichua community of Napo Province, Ecuador until the village of Capirona decided to investigate how they could benefit from tourism. The idea project was conceived of a communal ecotourism that allowed local community management. The people of Capirona built several tourist cabins in the traditional bamboo and thatch style, designed guided walks through the forest, prepared traditional meals, demonstrated hunting weapons, and presented a cultural program. The income came directly from the visitors and was invested into a community fund. From there, the community decided how the money was to be spent; *e.g.*, towards health emergencies, education instruction, or transportation improvements (Schaller, 1996).

The development and expansion of Kaieteur should not be viewed as a threat by local communities. A mechanism for the development of a communal ecotourism project may provide an avenue for Chenapau to feel that they have a stake in the development of that portion of the park that is near their communities. Creating economic incentives may encourage local stewardship to biological resources (Harlan, 2000).

Recently, the Patamona at Chenapau have signed an agreement with the World Wildlife Fund (WWF) and the Guyana Forest and Environmental Conservation Project (GFECP) to develop a sustainable eco-tourism programme at Chenapau. The grant will help construct a guesthouse and provide transportation to and from the airstrip at Kaieteur with the intention that Chenapau become a tourist destination. As a purely community-based venture, the Patamona at Chenapau hope the project will preserve both their traditional land and culture, and in turn, benefit the community (Anon., 2001). This venture will provide members of the community with training to become tour

guides, operators, and eco-tourism managers. As tour guides, the people of the local communities are provided with employment opportunities. Their intimate knowledge of the area, the local plants and animals, and their culture will give the visitor a richer understanding of the cultural and environmental history of the area. Research has shown that tourists enjoy “informative interactions” with local persons and consider their guide their “main source of learning” (Department for International Development, 2001).

Infrastructure development of the area around Kaieteur Falls and Tukeit

There are three categories of visitors that come to Kaieteur each year. The first category of tourist is the “nature” tourist who comes to view the falls and the Potaro River Gorge. It is estimated that 2,500 – 5,000 visitors come to Kaieteur each year (OAS, 1997). The majority of these visitors spend 1-2 hours on the plateau as part of a packet tour including other areas; *i.e.*, Orinduk Falls on the Ireng River between Brazil and Guyana or Baganara Island in the Essequibo River. The second category of visitors is comprised of researchers engaged in various scientific projects, students, and educational groups. These visitors spend anywhere from two to twenty-one days at the falls. The third category includes miners, Amerindians, and others that pass through the area.

Kaieteur Falls has been touted by Guyana’s nature tourist industry as having potential as a world-class attraction, but there is the need to improve the facilities. Extensive development has been proposed but this would take time, resources, and large amounts of money and the result may not be appropriate for Kaieteur National Park. The attractions of Kaieteur are, of course, the falls, but also the wildness and beauty of the park. For this type of experience, most nature tourists don’t mind “roughing it” for a while. They feel that it is part of the “jungle” experience. What they do require are two basic standards: security and hygiene.

As funding allows, infrastructure development of the park can proceed by stages. The initial stage should focus on the area immediately around the falls. This is the area that is most widely visited by tourists. Kaieteur currently has a large thatched “benab” and a shed that houses two toilets. The benab is generally in good condition but may need some work on the thatching. The toilets are non-functional, with no water supply for flushing. There are several toilet designs that do not depend on water that work well. One that is the most environmentally friendly and maintenance free is the composting toilet suggested by the National Plan for Ecotourism Development (Organization of American States, 1997).

The main guesthouse near the falls should be redesigned to accommodate overnight visitors. The design can be rustic, providing shelter, areas for hanging hammocks, sanitation facilities, and an area for cooking. The current house has two bedrooms, two bathrooms with showers, a living/dining area and a small kitchen. The basic structure of the house is sound but with some modifications it can be developed for low maintenance. The roof needs repair since it leaks in several areas. A catchment system for rainwater off the roof could provide water to the kitchen and bathroom areas. Experience shows that toilets and showers can stress the water supply at Kaieteur when there is a large group visiting. Compost style toilets, a design that does not entail flushing, can help conserve water during the dry season and avoid wastewater disposal problems. The two bedrooms could be opened into a bay with pairs of opposing hammock hooks evenly spaced so that several visitors can hang hammocks without “bumping”.

The kitchen could be equipped with a LP gas stove and a sink with running water for washing dishes. Central lighting in each room would be needed in the house. Electricity could be provided by several means. A generator is one method but this requires a supply of gasoline to be shipped and stored at the complex and creates noise which negatively impacts tourist experience. Other methods include a wind turbine or photovoltaic panels. Energy generated would supply lights to both the guesthouse and the smaller house in the back

and recharge a bank of batteries for back-up. Electricity supplied to the guesthouse could be limited to a few hours each evening (*i.e.*, sunset – 10 pm) to provide lights for visitors. Visitors wishing to stay at the guesthouse would have to make arrangements in advance, and would be required to provide their own hammocks and mosquito netting, food and toiletries.

Waste disposal is another issue that needs to be addressed. Proper containers for trash can be provided in several locations throughout the park (*i.e.*, airstrip, guesthouse, and along trails). A planned system of trash disposal should be developed that is environmentally friendly. In the past problems have arisen when visitors as well as wardens have created a trash dump or burned trash in open, uncontrolled areas near the falls.

The condition of the smaller house used by the park wardens is uncertain. A maintenance schedule for this facility needs to take into consideration sanitation, cooking, lights, roof, etc. The wardens should be trained in emergency medicine, snake bite treatment, etc. They will need to be equipped with a radio-transmitter to communicate with Georgetown, a medical kit, and a toolbox with a few basic tools. Other supplies can be provided or replaced as needed, such as generator parts or fluorescent light bulbs for the houses.

Development of Tukeit for tourism will depend on the demand. This area could be set up as a rustic campsite. A simple hut or benab placed on high ground to prevent flooding can provide visitors a place to hang a hammock. A small shelter where food can be prepared along with a designated cooking area to prevent fires should be placed separate from but close to the sleeping quarters. Finally, an area for waste disposal and sanitation facilities needs to be designed to keep the area clean.

Using Signage for Interpretation

Interpretation is a way of conveying information to people and could be a key component of communicating the importance of Kaieteur National Park to visitors. The three most popular forms of interpretation implemented by many parks worldwide are: guided walks, trail brochures, and signs.

Interpretation is educational and can be used to provide historical background on some of the landmarks or areas of interest, to emphasize important habitats or ecosystems, to promote conservation of the park, and to communicate rules and their function (Honig, 2000).

Kaieteur National Park is visited by thousand of people each year. Most of these visitors arrived by air-charters that are scheduled based on availability of passengers. This irregularly may make signage the best (or a very important) method for communication and interpretation in park. Signs are useful in that they are available to the visitor at all times. They can be set into place without a high cost, reducing the requirement for tour guides and staff or excessive maintenance. There are many publications that discuss the development and use of signs in park development (Roff, 1995; Ryan, 1995; Honig, 2000; Ham, 1992) and these can be reviewed to determine the best options for Kaieteur.

Signage can be used to designate a direction or location on a trail and provide a general orientation on a map of the area. Smaller signs can be used as trail guides and to provide information on an area of interest. At present, Kaieteur has three paths that are used by tourists. From the northern end of the airstrip, visitors may walk directly to the falls or head northward towards Johnson's View. The other path runs from Johnson's View to the falls. Although these paths are generally well defined by the trampling of many feet over the years, visitors have been known to become lost, requiring searches by rangers (M. Phang, pers. comm.). Signs at Kaieteur should therefore serve two purposes, enrichment and safety.

Currently, visitors are escorted or directed to the falls or Johnson's View and are returned to the planes often without detailed information on the habitats that they have walked through or the history or cultural aspects of the area. Signage along these trails can be used to highlight various points along the way and enrich the experience.

Points of interest along the "Airstrip – Johnson's View Trail" are the bush island habitats and the seemingly bare sandstone rock

which is inhabited by sundews, lichens, *Utricularia* and small frogs and tadpoles of *Leptodactylus rugosus*. At both sides of the forest entrance are large bromeliads (*Brocchinia micrantha*) with *Utricularia humboldtii*, the tallest and largest bladderwort in the world, growing out of their tanks. The conspicuous bird, Cock-of-the-rock, has his lek in this area, and tarantulas, lizards, snakes, and other animals have been seen or have left their mark on this trail. The path also has three sets of cement steps and two bridges that were built during British rule. Visitors may be interested in the historical ruins at Kaieteur. Signs at these sites can provide the visitor with information on when and why these structures were built.

On the "Airstrip – Falls Trail" the vegetation of the grass- and shrub-savanna is found, including many showy flowers of Bignoniaceae, Xyridaceae, Gentianaceae, and other plants. A sign can point out the trail of the leaf cutter ants that utilize the forest to cut sections of leaves to bring back to their nest. At the top of the falls are several plants endemic to Kaieteur. A sign near these plants can point out the importance of preserving the habitat in order that these rare plants may be enjoyed by future visitors.

Signs placed along the "Johnson's View – Falls Trail" can be used to bring the visitors attention to the many different plant species that grow near the edge of the gorge. Historical features along this trail include the remains of the "footing" of the old British guest house and the bucket that once served as the base to the outhouse. Can you imagine the surprise when the visitor realizes how close to the edge of the gorge the outhouse once stood?

Besides information on the flora, fauna and historical landmarks, signage can convey a strong message of conservation. Messages such as "take only pictures and leave only footprints" are used in a number of parks in the United States. The visitor understands that defacing landmarks, littering, and actions that may lead to the destruction of habitat are not acceptable.

The messages that are passed on to the visitor by signage can be very positive ones. Signs can point out features that may otherwise

be overlooked such as unique plant communities, areas that animals may frequently visit, and historical events or landmarks. Signage can convey the importance of staying on designated paths to prevent damage to fragile ecosystems and to keep visitors safe. And finally, signage can enrich the experience and give visitors the sense that it is not just the falls that make Kaieteur unique but the splendor of its forests, its wildlife and the indigenous people who live there.

Major Concerns to Consider

There are several major concerns about the welfare and condition of the park as it stands today. The Potaro River and smaller tributaries above and below the falls have been under siege by gold mining dredges. These dredges dig into the river banks and silt the waters (Anon., 1998a; Anon., 1998b). Diamond mining operations, though smaller in scale, also leave their marks on the landscape. Damage from trails and pits cut into the earth leave a legacy of environmental degradation. Although Guyana has placed a moratorium on any mining activity within the park (Ministry of Health, pers. comm.) and has enacted laws restricting this type of activity, lack of staff and financial resources has limited Guyana's ability to enforce these laws.

Over 2,500 tourists visit Kaieteur each year. The park is raw and rugged, which gives the visitor the thrill of being in the rainforest. But without proper signs, boardwalks, and guides, the potential for injury or losing a visitor along a trail is great. The unwary visitor wandering off the paths can also threaten delicate ecosystems. Crushing plants underfoot and breaking branches can lead to habitat degradation and erosion.

Mining and tourism are not the only threats to the environment. Other potential pressures on the environment are the capture of animals for the wildlife trade and commercial logging within the park.

CONCLUSION

Guyana stands at the threshold of developing its park and reserves system under the National Protected Area System (NPAS). The first area selected under the NPAS project was Kaieteur National Park. Although the Government of Guyana recognized the need to conserve a larger portion of the ecosystem and watershed and expanded the park to 627 square km, it failed to identify the needs of the local communities and the importance of the flora and fauna.

There are several ways in which local communities can be incorporated into the development and management of the park. As with many park projects of the past, the main problems confronted by governments have been the lack of understanding of the socio-economic and cultural realities of the local communities. Including the local communities in the decision making process and providing opportunities for local communities to develop and manage a communal ecotourism project that would benefit the people directly, may be the answer to some problems with park selection and development in Guyana. The Patamona people have lived in the area longer than most can remember. The legend of Kaieteur is passed down from their oral history. The Amerindians can enrich the visiting tourist through their local knowledge, customs and traditions.

Kaieteur National Park is not just a single feature park. The area has a rich geological, biological, and cultural history. Although the falls is a spectacular geological feature (single drop falls of 226 m), as noted in the phytogeography study of Kaieteur Falls (Kelloff and Funk, in review), the plants represent a unique phytogeographic region of South America. There are several rare and endemic animals found at Kaieteur in the immediate vicinity of the falls, but more inventories are needed in both plants and animals to fully understand the biological diversity of the Potaro Plateau.

Kaieteur needs to be developed in such a way that protection of the ecosystems generates income. The expansion of ecotourism within

Kaieteur National Park is one option. Kaieteur can be easily and cost effectively developed by simply renovating the existing buildings and sanitation facilities. Signage can be used to guide and educate the visitor at a low cost and provide an increased level of safety as the visitor moves around the park. It can also provide markers to prevent damage to fragile habitats and keep tourist safe. Signage can convey a message that visitors to Kaieteur can take with them - "It is not just the falls that make Kaieteur unique but the splendor of its forests, its wildlife and the indigenous people who live there". This strong conservation message needs to be conveyed in order to protect Kaieteur National Park. It is Guyana's natural heritage and it needs to be protected and preserved for future generations. Gold and diamond mining, unchecked and unplanned development, and the capture of animals for the wildlife trade present major threats to the ecosystems and can be detrimental to ecotourism as these activities can spoil the intrinsic beauty of the park and can reduce the safety of the tourists.

With the recent expansion of the park and the desire to make Kaieteur a World Heritage Site, more information is needed on the flora and fauna of this region. As more inventories are completed for both plants and animals in the park, a better knowledge and understanding of

the diversity and complexity of the ecosystems will be gained.

And finally, management and administration of national parks generally fall under the responsibility of the Government. If Kaieteur is to have a comprehensive management plan, there needs to be a single centralized agency to oversee and manage the park and all its activity. Table 4 is a short list of suggestions to help provide an initial framework towards developing and managing Kaieteur National Park. It is understood that there may be actions already taken by the Guyana Government toward this goal and unknown at the time of this writing. It should be noted that neither the list nor this paper constitute an infrastructure design plan for Kaieteur. Proper planning and development can only occur after a management plan has been formulated and adopted.

Perhaps, for Guyana, the legend of El Dorado will come true. However, the lure of gold and riches will not be from those that are dug out of the ground but come from the beauty of its natural heritage.

Table 4: Some suggestion to better meet the objectives towards developing conservation and ecotourism at Kaieteur National Park.

Topic	Suggested Action	Benefit
Forestry Legislation	Develop clear objectives in the National Forest Policy to prevent conflicts with the development of the NPAS.	Reduces conflict with Forestry.
Concession Moratorium	Stop all future mining and timber concession permits in Kaieteur National Park, including exploratory permits.	Prevents further damage to this fragile ecosystem.
Current Mining and Timber Permit in the Park	Do not renew permits.	Reduces concessions as permits run out.
Land Issues	Demarcate boundaries with Chenapau & establish zoning in the park near the village.	Reduces border conflicts and provides tradition and subsistence use for local communities.
Chenapau Village	Establish a dialog to resolve conflicts. Help Chenapau develop a project to help village benefit from ecotourism.	Establishes communications to help reduce conflicts with local communities.
Land Zoning	Establish areas within the park boundaries and around the perimeter of the park.	Clearly defines the area for use.
Administration	Establish one Government agency to be responsible for management of the park.	Centralizes management of the park.
Infrastructure Development: Phase I	Facilitate the overall management of the protected and improvement of lodging and signage.	Protection of the park and increased satisfaction of tourists and provide a safe and educational experience for visitors.
Infrastructure Development: Phase II	Develop a modest building plan for core area	Repair existing structure to keep initial cost low.
Scientific Research	Provides data and analysis on the plants and animals in the park	Provides policy makers with biodiversity information for zoning, developing, conservation; petition for World Heritage Site

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Appendix A: PROTECTED AREA CATEGORIES, PURPOSES AND PRACTICES PERMITTED TO LOCAL COMMUNITIES

1A. Strict Nature Reserve

Purpose: Strict protection and scientific research

Practices Permitted to Local Communities*:
Strict protection; no extraction permitted

1B. Wilderness Area

Purpose: Wilderness protection

Practices Permitted to Local Communities:

- Controlled, very limited extraction of certain natural products permitted: nuts, fruits, seeds, oils, medicinal plants
- Limited subsistence hunting and fishing
- Usually no human settlements inside

2. National Park

Purpose: Ecosystem protection and recreation

Practices Permitted to Local Communities:

- Controlled, very limited extraction of certain natural products permitted: nuts, fruits, seeds, oils, medicinal plants
- Limited subsistence hunting and fishing
- Very limited traditional mining
- Sometimes limited human settlements inside the area

3. Natural Monument

Purpose: Conservation of specific natural features, such as a waterfall, mountain

Practices Permitted to Local Communities:

- Controlled, very limited extraction of certain natural products permitted: nuts, fruits, seeds, oils, medicinal plants
- Occasional tree removal for subsistence use (canoes, tools, construction)
- Usually, no human settlements inside

4. Habitat or Species Management Area

Purpose: Conservation through specific management interventions for species and habitats

Practices Permitted to Local Communities:

- Subsistence fishing
- Limited commercial hunting and fishing
- Sport hunting and fishing
- Usually, no human settlement inside

5. Protected Landscape or Seascape

Purpose: Landscape/seascape conservation and recreation

Practices Permitted to Local Communities:

- Sustainable traditional uses, such as hunting, fishing, logging,
- agriculture, but not at industrial levels
- Limited traditional mining
- Some communities, usually within the area

6. Managed Resource Protected Area

Purpose: Sustainable use of national ecosystems

Practices Permitted to Local Communities:

- Sustainable logging, grazing, agriculture
- Small land dredges for mining
- Commercial fishing
- Some communities usually with the area

7. Biosphere Reserve

Purpose: Combination of strict protection, ecosystem protection and recreation, and sustainable use of national resources, through zoning (Very often made up of other protected areas at national level)

Practices Permitted to Local Communities:

- Combination of 1, 2 and 6 practices

* Local Communities defined as indigenous peoples, ethnic groups and other local people.

**APPENDIX B: LICHENIZED FUNGI AND BRYTOPHYTES OF
KAIETEUR NATIONAL PARK, GUYANA**
(compiled using collection data records of U.S. National Herbarium)

LICHENIZED FUNGI

Arthoniaceae

Cryptothecia sp.

Bacidiaceae

Biatora sp.

Crocynia pyxinoides Nylander

Crocynia pyxnoides Nylander

Lecidea leucophyllina Nylander

Phyllopsora buettneri (Mueller-Argoviensis)
Zahlbruckner

Phyllopsora sp.

Physcidia squamulosa Tuckerman

Physcidia wrightii Tuckerman

Cladoniaceae

Cladia aggregata (Swartz) Nylander

Cladina argentea Ahti

Cladina confusa (R. Santesson) Follmann &
Ahti

Cladina confusa (R. Santesson) Follmann &
Ahti f. *confusa*

Cladina dendroides (Abbayes) Ahti

Cladina densissima Ahti

Cladina rangiferina (Linnaeus) Nylander

Cladina sprucei (Ahti) Ahti

Cladonia aggregata (Swartz) Nylander

Cladonia ahtii S. Stenroos

Cladonia chimantae Ahti ined.

Cladonia coniocraea (Flörke) Sprengel f.

Cladonia corallifera (Kunze) Nylander

Cladonia crassiuscula Ahti

Cladonia delicatula Ahti ined.

Cladonia didyma (Fée) Vainio

Cladonia furcata (Hudson) Schrader

Cladonia furfuracea Vainio

Cladonia hians Ahti

Cladonia huberi Ahti

Cladonia meridionalis Vainio

Cladonia mollis Ahti

Cladonia peltastica (Nylander) Mueller-
Argoviensis

Cladonia pityrophylla Nylander

Cladonia polita Ahti

Cladonia polyscypha Ahti & Xavier Filho

Cladonia prancei Ahti

Cladonia pulviniformis Ahti

Cladonia rugulosa Ahti

Cladonia secundana Nylander

Cladonia signata (Eschweiler) Vainio

Cladonia sipmanii Ahti

Cladonia spinea Ahti

Cladonia subradiata (Vainio) Sandstede

Cladonia substellata Vainio

Cladonia vareschii Ahti

Cladonia variegata Ahti

Coccocarpiaceae

Coccocarpia domingensis Vainio

Coccocarpia imbricascens Nylander

Coccocarpia sp.

Ectolechiaceae

Calopadia sp.

Graphidaceae

Cyclographina sp.

Graphina malmeana

Graphina sp.

Gyalectaceae

Coenogonium linkii Ehrenb.

Coenogonium sp.

Lichen – unknown families

Lichenothrix sp.

Trentopholia? sp.

Lichen Incert. sed.

Siphula carassana Mueller-Argoviensis

Siphula carassana Vainio

Siphula decumbens Nylander

Lichenized basidio.

Dictyonema glabratum (Sprengel) D.

Hawksworth

Dictyonema sericeum (Swartz) Berkeley

Lobariaceae

Sticta sp.

Megalosporaceae

Megalospora tuberculosa (Fée) Sipman

Opegraphaceae

Dichosporidium nigrocinctum (Ehrenberg)

Thor

Parmeliaceae

Bulbothrix goebelii (Zenker) Hale

Bulbothrix tabacina (Montagne & Bosch)
Hale

Canoparmelia caroliniana

Parmeliopsis minarum (Vainio) Elix & Hale
Parmeliopsis subfatisca (Kurokawa) Elix & Hale
Parmotrema latissimum (F, e) Hale
Parmotrema mellissii (Dodge) Hale
Parmotrema subochraceum Hale
Parmotrema sulphuratum (Nees & Flotow) Hale
Pseudoparmelia sphaerospora (Nylander) Hale
Relicina abstrusa (Vainio) Hale
Usnea sp.

Pertusariaceae

Pertusaria velata (Turner) Nylander

Ramalinaceae

Ramalina anceps Nylander

Thelotremataceae

Myriotrema neofrondosum Sipman
Myriotrema wrightii (Tucker) Hale
Ocellularia auberiana (Montagne) Hale
Thelotrema sp.

Trichotheliaceae

Clathroporina sp.

Trypetheliaceae

Polymeridium catapastum (Nylander) R.C. Harris
Polymeridium simulans R.C. Harris
Trypethelium aeneum (Eschweiler) Zahlbruckner
Trypethelium sp.

BRYTOPHYTES**Bartramiaceae**

Philonotis uncinata (Schwaegrichen) Bridel
Philonotis uncinata (Schwaegrichen) Bridel
 var. *glaucescens* (Hornschuch) J. Florschütz

Bryaceae

Bryum apiculatum Schwaegrichen
Bryum billardieri Schwaegrichen
Bryum ellipsifolium Müller Halle

Calymperaceae

Calymperes lonchophyllum Schwaegrichen
Calymperes nicaraguense Renauld & Cardot
Calymperes platyloma Mitten
Calymperes venezuelanum (Mitten) Brotherus ex Pittier

Syrrhopodon elongatus Sullivant var. *glaziovii* (Hampe) Reese
Syrrhopodon hornschi Martius
Syrrhopodon leprieurii Montin
Syrrhopodon rigidus Hooker & Greville
Syrrhopodon simmondsii Steere
Syrrhopodon tortilis Hampe

Dicranaceae

Bryohumbertia filifolia (Hornschuch) Frahm
Campylopus cubensis Sullivant
Campylopus richardii Bridel
Campylopus savannarum (Müller Halle) Mitten
Campylopus surinamensis Müller Halle
Campylopus trachylepharon (Müller Halle) Mitten
Eucamptodontopsis pilifera (Mitten) Brotherus
Leucoloma cruegerianum (Müller Halle) A. Jaeger
Leucoloma mariei Bescherville
Leucoloma serrulatum Bridel

Fissidentaceae

Fissidens diplodus Mitten var. *diplodus*
Fissidens inaequalis Mitten
Fissidens radicans Montagne

Hookeriaceae

Brymela parkeriana (Hooker & Greville) Buck
Callicosta bipinnata (Schwaegrichen) Müller Halle
Callicostella pallida (Hornschuch) Ångström
Hookeriopsis cruegeriana (Müller Halle.) Jacquin
Hookeriopsis parkeriana (Hooker & Greville) Jacquin
Hypnella pallescens (Hooker) A. Jaeger
Lepidopilidium portoricense (Müller Halle) Crum & Steere
Lepidopilum radicale Mitten
Lepidopilum scabrisetum (Schwaegrichen) Steere
Lepidopilum surinamense Müller Halle
Thamniopsis killipii (Williams) E.B.

Bartram

Hypnaceae

Ectropothecium leptochaeton (Schwaegrichen) W.R. Buck
Isopterygium tenerum (Swartz) Mitten
Rhacopilopsis trinitensis (Müller Halle.) Britton & Dixon

Leucobryaceae

- Leucobryum crispum Müller Halle
- Leucobryum martianum (Hornschuch) Hampe
- Octoblepharum albidum Hedwig
- Octoblepharum cocuiense Mitten
- Octoblepharum stramineum Mitten

Leucomiaceae

- Leucomium strumosum (Hornsch.) Mitten

Meteoriaceae

- Squamidium leucotrichum (Taylor) Brotherus
- Zelometeorium patulum (Hedwig) Manuel

Neckeraceae

- Isodrepanium lentulum (Wilson) E. Britton

Orthotrichaceae

- Groutiella obtusa (Mitten) Florschütz
- Macromitrium cirrosum (Hedwig) Bridel
- Macromitrium podocarpi C. Mueller
- Macromitrium portoricense Williams
- Macromitrium punctatum (Hooker & Greville) Bridel
- Macromitrium sp.
- Macromitrium trinitense Williams

Phylloandrepaniaceae

- Phylloandrepanium falcifolium
(Schwaegrichen) Crosby

Pottiaceae

- Trichostomum brachydontium Bruch
- Trichostomum duidense E.B. Bartram

Pterobryaceae

- Orthostichopsis praetermissa W.R. Buck
- Orthostichopsis tetragona (Swartz ex Hedwig)
Brotherus
- Renauldia paradoxa B.H. Allen

Rhizogoniaceae

- Pyrrhobryum spiniforme (Hedwig) Mitten

Sematophyllaceae

- Acroporium pungens (Hedwig) Brotherus
- Potamium vulpinum (Montagne) Mitten
- Sematophyllum subsimplex (Hedwig) Mitten
- Taxithelium concavum (Hooker) Spruce
- Taxithelium planum (Bridel) Mitten
- Trichosteleum bolivarense H. Robinson
- Trichosteleum hornschuchii (Hampe) A.
Jaeger var. subglabratum J. Florschütz

Appendix C: INVERTEBRATES OF KAIETEUR NATIONAL PARK, GUYANA; BUTTERFLIES, MOTHS, AND TERMITES

Butterflies and Moths

This list represents a fairly complete summary of the true butterflies species encountered in the upper gorge between Tukeit and Kaieteur Falls and on the plateau near the falls. This list of approximately 170 species is no where near complete. A few hundred more species should be found there and hesperide (skippers) which are not represented on the list should add at least a couple of hundred more species. Prepared by Steven Fratello, 2001 and reviewed by Don Harvey and Robert Robbins (SI).

Papilionidae (Swallowtails)

Battus belus
Eurytides dolicaon
Eurytides protesilaus – complex
Eurytides ariarathes
Parides chabrias mithras
Parides sesostris
Parides aeneas
Parides vertumnus
Parides lysonder
Parides echemon
Papilio thoas

Pieridae (Sulphurs and Whites)

Moschoneura pinthaeus
Appias drusilla
Aphrissa statira
Phoebis argante
Phoebis philea
Phoebis trite
Leucidia brephos

Nymphalidae: Ithomiinae (Glass-Wings)

Melinaea “mneme”
Melinaea satevis
Mechanitis mazaesus
Mechanitis polymnia
Napeogenes cyrianassa
Hypothyris ninonia
Clearwing species – undetermined

Nymphalidae: Heliconiinae (Long-Wings)

Philaethria dido
Dryas julia

Eveides species
Heliconius aoede
Heliconius xanthocles
Heliconius numata / ethilla
Heliconius melpomene / erato
Heliconius sara
Heliconius antiochus

Nymphalidae: Nymphalinae

Eresia eunice
Tigridia acesta
Ectima thecla
Nessaea batesii
Eunica viola
Callicore cynosura
Dynamine tithia
Adelpha sp.
Metamorphia stelenes
Junonia lavinia
Junonia sp.
Anartia jatrophae

Nymphalidae: Charaxinae

Agrias pericles
Agrias claudia
Archaeoprepona sp.
Prepona eugenes
Fountainia sp.
Memphis sp.
Hypna clytemnestra
Siderone marthesia

Nymphalidae: Morphinae (Morphos)

Morpho iphidamus
Morpho hecuba
Morpho adonis
Morpho rhetenor
Morpho menelaus
Morpho deidamia
Morpho achilles / helenor

Nymphalidae: Satyrinae

(Satyus, Wood Nymphs)

Pierella rhea
Pierella astyoche
Pierella lena
Pierella hyalinus
Haetera piera

Cithaerias andromeda
 Bia actorion
 Euptychia hesione
 Euptychia calpurnia
 Euptychia terrestris
 Euptychia batesii
 Chloreuptychia arnaea
 Euptychia tricolor
 Euptychia picea
 Erichthodes erichtho

Riodinidae (Metalmarks)

Euselasia eumedia
 Euselasia issoria
 Euselasia evodias
 Euselasia melaphaea
 Euselasia nr. inconspicua
 Euselasia gelanor
 Euselasia midas
 Euselasia lycaeus
 Methone cecilia
 Helicupis cupido
 Perophtalma tullius
 Leucochimona hyphea
 Mesosemia nina
 Mesosemia cippus
 Mesosemia ibycus
 Mesosemia methion
 Mesosemia maera
 Mesosemia coea
 Mesosemia melaene
 Mesosemia philocles
 Mesosemia machaera
 Mesosemia magete
 Mesosemia phace
 Mesosemia ulrica
 Hyphilaria anthias
 Hyphilaria nica
 Eurybia nicaeus
 Eurybia nr. nicaeus
 Pheles heliconides
 Ithomiola floralis
 Alesa amesis
 Napaea sp. nov.
 Napaea nepos
 Cremna actoris
 Cremna sp.
 Eunogyra satyrus
 Ancyluris meliboeus
 Rhetus periander
 Charis cleonus
 Charis anius
 Juditha azan

Synargis abaris
 Synargis sp.
 Nymphidium caricae
 Nymphidium acherois
 Nymphidium cachrus
 Nymphidium menalcus
 Nymphidium lisimon
 Nymphidium derufuta
 Nymphidium baeotia complex
 Stalachtis calliope
 Stalachtis phaedusa
 Stalachtis euterpe
 Lemonias egaensis
 Lemonias zygia
 Theope sp.
 Theope nycteis
 Sarota chrysus
 Emesis lucinda
 Menander hebrus
 Thisbe irenea
 Echenais thelephus
 Calospila rhodope
 Calospila emylius
 Adelotypa huebneri

Lycaenidae (Hairstreaks)

Calycopis sp.
 Calycopis cerata
 Panthiades bitias
 Panthiades aeolus
 Lamprospilus collucia
 Paiwarria telemus
 Evenus sp.
 Theritas mavors
 Theritas hemon
 Theritas lisus
 Ocaria thales
 Arawacus aetolus
 Chalybs jantias
 Thestius pholeus
 Janthecla sista
 Theclopsis lydus
 Thecla aruma
 Thecla aff. adela
 Thecla ligurina
 Thecla tarena
 Thecla athymbra
 Thecla munditia
 Celmia celmus

TERMITES (Isoptera)Rhinotermitidae

Dolichorhinotermes longilabius
Dolichorhinotermes nr. tenebrosus
Heterotermes tenuis
Coptotermes testaceus

Termitidae

Apicotermitinae

Anoplotermes banksi
Anoplotermes sp. A
Anoplotermes sp. B
Anoplotermes sp. C

Termitinae

Cylindrotermes parvignathus
Neocapritermes sp. A
Termes fatalis

Nasutitermitinae

Arimitermes minutus
Embiratermes sp. A
Araujotermes parvulus
Coatitermes kartaboensis
Nasutitermes banksi
Nasutitermes intermedius
Nasutitermes gaigei
Nasutitermes sp. A
Nasutitermes sp. B
Nasutitermes sp. C
Nasutitermes sp. D

Appendix D: VERTEBRATES OF KAIETEUR NATIONAL PARK, GUYANA: BIRDS, HERPETOFAUNA, AND MAMMALS

BIRDS

Compiles from field observations of M. Braun,
C. Milensky, B. O'Shea, and D.W. Finch. >>>
Based on >>>>>>

TINAMIDAE

Great Tinamou (*Tinamus major*)
Variegated Tinamou (*Crypturellus variegatus*)

ARDEIDAE

Zigzag Heron (*Zebrilus undulatus*)
Striated Heron (*Butorides striatus*)
Rufescent Tiger-Heron (*Tigrisoma lineatum*)
Great Egret (*Ardea alba*)

THRESKIORNITHIDAE

Green Ibis (*Mesembrinibis cayennensis*)

CATHARTIDAE

Turkey Vulture (*Cathartes aura*)
Greater Yellow-headed Vulture (*Cathartes melambrotus*)
King Vulture (*Sarcorampus papa*)

ACCIPITRIDAE

Pearl Kite (*Gampsonyx swainsonii*)
White Hawk (*Leucopternis albicollis*)
Great Black Hawk (*Buteogallus urubitinga*)
Roadside Hawk (*Buteo magnirostris*)
White-tailed Hawk (*Buteo albicaudatus*)

FALCONIDAE

Barred Forest-Falcon (*Micrastur ruficollis*)
Red-throated Caracara (*Daptrius americanus*)
Yellow-headed Caracara (*Milvago chimachima*)
Merlin (*Falco columbarius*)
Laughing Falcon (*Herpetotheres cachinnans*)
Bat Falcon (*Falco rufifigularis*)
Orange-breasted Falcon (*Falco deiroleucus*)

CRACIDAE

Little Chachalaca (*Ortalis motmot*)
Blue-throated Piping-Guan (*Pipile cumanensis*)
Black Curassow (*Crax alector*)

EURYPYGIDAE

Sunbittern (*Eurypyga helias*)

SCOLOPACIDAE

Solitary Sandpiper (*Tringa solitaria*)
Spotted Sandpiper (*Actitis macularia*)
Least Sandpiper (*Calidris minutilla*)
White-Rumped Sandpiper (*Calidris fuscicollis*)

COLUMBIDAE

Scaled Pigeon (*Columba speciosa*)
Ruddy Pigeon (*Columba subvinacea*)
Plumbeous Pigeon (*Columba plumbea*)
Common Ground-Dove (*Columbina passerina*)
Gray-fronted Dove (*Leptotila rufaxilla*)
White-tipped Dove (*Leptotila verreauxi*)
Ruddy Quail-Dove (*Geotrygon montana*)

PSITTACIDAE

Red-and-Green Macaw (*Ara chloroptera*)
Painted Parakeet (*Pyrrhura picta*)
Parrotlet species (*Forpus* sp.)
Black-headed Parrot (*Pionites melanocephala*)
Dusky Parrot (*Pionus fuscus*)
Blue-headed Parrot (*Pionus menstruus*)
Orange-winged Parrot (*Amazona amazonica*)
Mealy Parrot (*Amazona farinosa*)
Red-fan Parrot (*Deroptryus accipitrinus*)

CUCULIDAE

Black-bellied Cuckoo (*Piaya melanogaster*)
Smooth-billed Ani (*Crotophaga ani*)

STRIGIDAE

Tawny-bellied Screech-Owl (*Otus watsoni*)

CAPRIMULGIDAE

Paurague (*Nyctidromus albicollis*)

APODIDAE

White-Collared Swift (*Streptoprocne zonaris*)
White-Chinned Swift (*Cypseloides cryptus*)

White-tipped Swift (*Aeronautes montivagus*)
Band-rumped Swift (*Chaetura spinicauda*)

TROCHILIDAE

- Long-tailed Hermit (*Phaethornis superciliosus*)
- Straight-billed Hermit (*Phaethornis bourcieri*)
- Reddish Hermit (*Phaethornis ruber*)
- White-necked Jacobin (*Florisuga mellivora*)
- Tufted Coquette (*Lophornis ornatus*)
- Fork-tailed Woodnymph (*Thalurania furcata*)
- Green-tailed Goldenthrout (*Polytmus theresiae*)
- Glittering-throated Emerald (*Amazilia fimbriata*)
- Black-eared Fairy (*Heliophryx aurita*)

TROGONIDAE

- White-tailed Trogon (*Trogon viridis*)
- Black-throated Trogon (*Trogon rufus*)
- Black-tailed Trogon (*Trogon melanurus*)
- Violaceous Trogon (*Trogon violaceus*)

BUCCONIDAE

- Swallow-wing (*Chelidoptera tenebrosa*)

ALCEDINIDAE

- Ringed Kingfisher (*Ceryle torquata*)
- Amazon Kingfisher (*Chloroceryle amazona*)
- Green Kingfisher (*Chloroceryle americana*)

GALBULIDAE

- Paradise Jacamar (*Galbula dea*)
- Yellow-Billed Jacamar (*Galbula albirostris*)

RAMPHASTIDAE

- Channel-billed Toucan (*Ramphastos vitellinus*)
- Red-billed Toucan (*Ramphastos tucanus*)
- Black-spotted Barbet (*Capito niger*)
- Black-necked Aracari (*Pteroglossus aracari*)

PICIDAE

- Yellow-throated Woodpecker (*Piculus flavigula*)
- Lineated Woodpecker (*Dryocopus lineatus*)
- Waved Woodpecker (*Ceolus undatus*)

- Red-necked Woodpecker (*Campephilus rubicollis*)

FURNARIIDAE

- Foliage-gleaner sp. (*Philydor* sp.)
- Plain Xenops (*Xenops minutus*)

DENDROCOLAPTIDAE

- Wedge-billed Woodcreeper (*Glyphorhynchus spirurus*)
- Chestnut-rumped Woodcreeper (*Xiphorhynchus pardalotus*)
- Plain-brown Woodcreeper (*Dendrocicla fuliginosa*)
- Lineated Woodcreeper (*Lepidocolaptes albolineatus*)

THAMNOPHILIDAE

- Mouse-colored Antshrike (*Thamnophilus murinus*)
- Dusky-throated Antshrike (*Thamnomanes ardesiacus*)
- Cinereous Antshrike (*Thamnomanes caesius*)
- Spot-Tailed Antwren (*Herpsilochmus sticturus*)
- Todd's Antwren (*Herpsilochmus stictocephalus*)
- Pygmy Antwren (*Myrmotherula brachyura*)
- Rufous-bellied Antwren (*Myrmotherula guttata*)
- White-flanked Antwren (*Myrmotherula axillaris*)
- Long-winged Antwren (*Myrmotherula longipennis*)
- Gray Antwren (*Myrmotherula menetriesii*)
- Ash-winged Antwren (*Terenura spodioptila*)
- Gray Antbird (*Cercomacra cinerascens*)
- Scale-backed Antbird (*Hylophylax poecilinota*)
- Warbling Antbird (*Hypocnemis cantator*)
- Black-chinned Antbird (*Hypocnemoides melanopogon*)
- Ferruginous-backed Antbird (*Myrmeciza ferruginea*)
- Spot-winged Antbird (*Schistocichla leucostigma*)
- White-plumed Antbird (*Pithys albifrons*)

FORMICARIIDAE

- Black-faced Antthrush (*Formicarius analis*)
- Thrush-like Antpitta (*Myrmothera campanisona*)

TYRANNIDAE

- White-lored Tyrannulet (*Ornithion inermis*)
- Forest Elaenia (*Myiopagis gaimardii*)
- Tropical Kingbird (*Tyrannus melancholicus*)
- White-ringed Flycatcher (*Conopias parva*)
- Yellow-throated Flycatcher (*Conopias parva*)
- Rusty-margined Flycatcher (*Myiozetetes*)

cayanensis)
 Bright-rumped Attila (*Attila spadiceus*)
 Grayish Mourner (*Rhytipterna simplex*)
 Dusky-capped Flycatcher (*Myiarchus tuberculifer*)
 Cliff Flycatcher (*Hirundinea ferruginea*)
 Helmeted Pygmy Tyrant (*Lophotriccus galeatus*)
 Yellow-margined Flycatcher (*Tolmomyias assimilis*)
 Common Tody-Flycatcher (*Todirostrum cinereum*)
 Ringed Antpiper (*Corythopsis torquata*)
 Plain-crested Elaenia (*Elaenia cristata*)
 Rufous-crowned Elaenia (*Elaenia ruficeps*)
 Yellow-bellied Elaenia (*Elaenia flavogaster*)
 Lesser Elaenia (*Elaenia chiriquiensis*)
 Ochre-bellied Flycatcher (*Mionectes oleagineus*)
 McConnell's Flycatcher (*Mionectes macconnelli*)
 Slender-footed Tyrannulet (*Zimmerius gracilipes*)
 Ruddy-tailed Flycatcher (*Terenotriccus erythrurus*)
 Screaming Piha (*Lipaugus vociferans*)

COTINGIDAE

Purple-breasted Cotinga (*Cotinga cotinga*)
 Pompadour Cotinga (*Xipholena punicea*)
 Guianan Cock-of-the-Rock (*Rupicola rupicola*)
 Capuchinbird (*Perissocephalus tricolor*)
 White Bellbird (*Procnias alba*)

PIPRIDAE

White-throated Manakin (*Corapipo gutturalis*)
 Golden-headed Manakin (*Pipra erythrocephala*)
 White-crowned Manakin (*Pipra pipra*)
 Tepui Manakin (*Lepidothrix suavisima*)
 Tiny Tyrant-Manakin (*Tyrannetes virescens*)
 Thrush-like Manakin (*Schiffornis turdinus*)

VIREONIDAE

Buff-cheeked Greenlet (*Hylophilus muscicapinus*)
 Tawny-crowned Greenlet (*Hylophilus ochraceiceps*)

CORVIDAE

Cayenne Jay (*Cyanocorax cayanus*)

HIRUNDINIDAE

White-winged Swallow (*Tachycineta albiventer*)
 White-banded Swallow (*Atticora fasciata*)
 Barn Swallow (*Hirundo rustica*)

TROGLODYTIDAE

Coraya Wren (*Thryothorus coraya*)
 Southern House-Wren (*Troglodytes musculus*)
 White-breasted Wood-Wren (*Henicorhina leucosticta*)
 Wing-banded Wren (*Microcerculus bambla*)
 Musican Wren (*Cyphorhinus arada*)
 Long-billed Gnatwren (*Ramphocaenus melanurus*)

TURDIDAE

Cocoa Thrush (*Turdus fumigatus*)

PARULIDAE

River Warbler (*Phaeothlypos flaveolus*)

COEREVIDAE

Bananaquit (*Coereba flaveola*)

THRAUPIDAE

Purple Honeycreeper (*Cyanerpes caeruleus*)
 Red-legged Honeycreeper (*Cyanerpes cyaneus*)
 Green Honeycreeper (*Chlorophanes spiza*)
 Purple Honeycreeper (*Cyanerpes caeruleus*)
 Blue Dacnis (*Dacnis cayana*)
 Spotted Tanager (*Tangara punctata*)
 Bay-headed Tanager (*Tangara gyrola*)
 Burnished-buff Tanager (*Tangara cayana*)
 Purple-throated Euphonia (*Euphonia chlorotica*)
 Orange-bellied Euphonia (*Euphonia xanthogaster*)
 Plumbeous Euphonia (*Euphonia plumbea*)
 Blue-gray Tanager (*Thraupis episcopus*)
 Palm Tanager (*Thraupis palmarum*)
 Silver-beaked Tanager (*Ramphocelus carbo*)
 Fulvous Shrike-Tanager (*Lanio fulvus*)
 Flame-crested Tanager (*Tachyphonus cristatus*)
 White-lined Tanager (*Tachyphonus rufus*)
 Fulvous-crested Tanager (*Tachyphonus surinamus*)
 Red-shouldered Tanager (*Tachyphonus phoeniceus*)

EMBERIZIDAE

- Slate-colored Grosbeak (*Pitylus grossus*)
- Yellow-green Grosbeak (*Caryothraustes canadensis*)
- Blue-black Grassquit (*Volatinia jacarina*)

ICTERIDAE

- Green Oropendola (*Psarocolius viridis*)
- Red-rumped Cacique (*Cacicus haemorrhous*)
- Moriche Oriole (*Icterus chryscephalus*)

HERPETOFAUNA

Prepared by C.J. Cole and C. R. Townsend,
American Museum of Natural History;
R. Reynolds, U.S. Department of Agriculture

SnakesColubridae

- Liophis purpurans*
- Liophis typhlus*

Viperidae

- Bothrops atrox* (Laborea)

LizardsAmphisbaenidae

- Amphisbaena fuliginosa*

Gekkonidae

- Gonatodes annularis*

Gymnophthalmidae

- Neusticus rudis*

Iguanidae (Iguana family)

- Plica umbra*

Polychrotidae

- Anolis fuscoauratus*
- Anolis* sp.

Scincidae

- Mabuya* sp.

Teiidae

- Ameiva ameiva*
- Bachia monodactylus*
- Cnemidophorus* sp.
- Dracaena guianensis*
- Kentripyx calcaratus*

FrogsBufonidae

- Bufo guttatus*
- Bufo marinus*
- Bufo nasicus*
- Bufo typhonius*

Dendrobatidae (poison arrow frogs)

- Colostethus beebei*
- Colostethus brunneus*

Hylidae

- Gastrotheca* sp. nov.
- Hyla boans*
- Phrynohyas venulosa*
- Stefania woodleyi*

Leptodactylidae

- Leptodactylus fuscus*
- Leptodactylus longirostris*
- Leptodactylus rugosus*

Microhylidae

- Synapturanu mirandaribeiro*

MAMMALS

This list of the mammals has been compiled using Lim and Engstrom (ms.) and Engstrom and Lim (2001) and common names, where available, from Emmons (1997). Notation has been made on whether the species has been collected (V), observed (OBS) or expected (E) based on distribution.

ORDER DIDELPHIMORPHIA (opossums)Family Didelphidae (opossums)**Subfamily Caluromyinae (woolly opossums)**

- Caluromys philander* (Bare-tailed woolly opossum) - E

Subfamily Didelphinae (opossums)

- Chironectes minimus* (Water opossum)
- Didelphis imperfectus* E
- Didelphis marsupialis* (Common opossum)E
- Marmosa murina* (Murine mouse opossum)-E
- Marmosops pinheiroi* - E
- Metachirus nudicaudatus* E
- Micoureus demerarensis* E
- Monodelphis brevicaudata* (red-legged opossum) E
- Philander opossum* (Common gray four-eyed opossum) E

ORDER XENARTHRA (xenarthrans)Family Bradypodidae (three-toed sloths)

- Bradypus tridactylus* (pale-throated sloth) E

Family Megalonychidae (two-toes sloths)

Choloepus didactylus (southern sloth) E

Family Dasypodidae (armadillos)

Dasypus novemcinctus (nine-banded long nose armadillo) E

Priodontes maximus (giant armadillo) E

Family Myrmecophagidae (anteaters)

Cyclopes didactylus (silky or pigmy anteater) E

Myrmecophaga tridactyla (giant anteater) E

Tamandua tetradactyla (collared or southern tamandua) E

ORDER CHIROPTERA (bats)

Family Emballonuridae (sheath-tailed bats)

Cormura brevirostris (chestnut sac-winged bat) V

Diclidurus scutatus (ghost bat) E

Peropteryx kappleri (doglike sac-winged bat) E

Peropteryx macrotis (doglike sac-winged bat) E

Rhynchonycteris naso (long-nosed bat) E

Saccopteryx bilineata (white-lined sac-winged bat) E

Saccopteryx canescens (white-lined sac-winged bat) E

Saccopteryx leptura (white-lined sac-winged bat) E

Family Noctilionidae (bulldog bats)

Noctilio albiventris (Lesser Bulldog bat) E

Noctilio leporinus (Bulldog bat) E

Family Mormoopidae (leaf-chinned bats)

Pteronotus gymnotus E

Pteronotus parnellii V

Pteronotus personatus E

Family Phyllostomidae

(New World leaf-nosed bats)

Subfamily Phyllostominae (New World leaf nosed bats)

Chrotoperus auritus (woolly false vampire bat) E

Lonchorhina aurita (common sword-nosed bat) E

Macrophyllum macrophyllum (long-legged bat) E

Micronycteris brachyotis (little big-eared bat) E

Micronycteris hirsuta (little big-eared bat) E

Micronycteris megalotis (little big-eared bat) E

Micronycteris microtis (little big-eared bat) E

Micronycteris minuta (little big-eared bat) E

Micronycteris nicefori (little big-eared bat) E

Micronycteris sylvestris (little big-eared bat) E

Mimon crenulatum (hairy-nosed bat) E

Phylloderma stenops (pale-face bat) E

Phyllostomus discolor (spear-nosed bat) E

Phyllostomus elongatus (spear-nosed bat) E

Phyllostomus hastatus (spear-nosed bat) E

Tonatia brasiliense (round-eared bat) E

Tonatia carrikeri (round-eared bat) E

Tonatia saurophila (round-eared bat) E

Tonatia silvicola (round-eared bat) E

Trachops cirrhosus (fringe-lipped bat) E

Vampyrus spectrum (false vampire bat) E

Subfamily Glossophaginae (nectar-feeding bats)

Anoura caudifera (hairy-legged bat) V

Anoura geoffroyi (hairy-legged bat) V

Choeroniscus minor (long-nosed bat) E

Glossophaga longirostris (common nectar-feeding bat) E

Glossophaga soricina (common nectar-feeding bat) E

Lionycteris spurrelli (dark nectar-feeding bat) V

Lonchophylla thomasi (spear-nosed nectar-feeding bat) V

Subfamily Carolliinae (New World fruit bats)

Carollia brevicauda (short-tailed bat) E

Carollia perspicillata (short-tailed bat) V

Rhinophylla pumilio (little fruit bat) V

Subfamily Stenodermatinae (New World fruit-eating bats)

Ametrida centurio (little white shouldered bat) E

Artibeus amplus (large fruit-eating bat) V

Artibeus cinereus (large fruit-eating bat) E

Artibeus concolor (large fruit-eating bat) E

Artibeus gnomus (large fruit-eating bat) E

Artibeus lituratus (large fruit-eating bat) E

Artibeus obscurus (large fruit-eating bat) E

Artibeus planirostris (large fruit-eating bat) E

Chiroderma trinitatum (big-eyed bat) E

Chiroderma villosus (big-eyed bat) E

Mesophylla macconnelli (Macconnell's bat) E

Platyrrhinus aurarius E
 Platyrrhinus brachycephalus E
 Platyrrhinus helleri E
 Sturnira lilium (yellow-shouldered bat) E
 Sturnira tildae (yellow-shouldered bat) E
 Uroderma bilobatum (tent-making bat) E
 Vampyressa bidens (yellowed-eared bat) E
 Vampyroides caraccioli (yellowed-eared bat) E

Subfamily Desmodontinae (vampire bats)

Desmodus rotundus (common vampire bat) E
 Diaemus youngi (white-wing vampire bat) E

Family Furipteridae (thumbless bats)

Furipterus horrens (thumbless bat) E

Family Thyropteridae (disc-winged bats)

Thyroptera tricolor (sucker-footed bat) E

Family Vespertilionidae (vesper bats)

Eptesicus furinalis (big brown bat) E
 Lasiurus atratus (hairy-tailed bat) E
 Lasiurus blossevillii (hairy-tailed bat) E
 Lasiurus ega (hairy-tailed bat) E
 Myotis albescens (little brown bat) E
 Myotis nigricans (little brown bat) V
 Myotis riparius (little brown bat) E

Family Molossidae (free-tailed bats)

Cynomops abrasus (doglike bat) E
 Cynomops parvus (doglike bat) E
 Cynomops planirostris (doglike bat) E
 Eumops aripundulus (bonneted bat) E
 Eumops glaucinus (bonneted bat) E
 Eumops hansae (bonneted bat) E
 Eumops trumbulli (bonneted bat) E
 Molossus ater (dog-faced bat) E
 Molossus molossus (dog-faced bat) E
 Nyctinomops laticaudatus (broad-eared bat) E
 Nyctinomops macrotis (broad-eared bat) E
 Promops centralis (crested bat) E
 Promops nasutus (crested bat) E

ORDER PRIMATES (primates)

Family Callitrichidae (marmosets)

Saguinus midas (Golden-handed tamarin) E

Family Cebidae (New World monkeys)

Subfamily Alouattinae (howler monkeys)

Alouatta seniculus (red howler monkey) OBS

Subfamily Cebinae (New World monkeys)

Cebus olivaceus (wedge-capped capuchin)

OBS

Saimiri sciureus (common squirrel monkey)

E

Subfamily Pitheciinae (sakis and uakaris)

Chiropotes satanas (brown bearded saki) E

Pithecia pithecia (guianan saki) E

ORDER CARNIVORA (carnivores)

Family Canidae (dogs)

Cerdocyon thous E

Speothos venaticus (bush dog) OBS

Family Felidae (cats)

Subfamily Felinae (cats)

Herpailurus yagouaroundi (jaguarundi) OBS

Leopardus pardalis (ocelot) E

Leopardus tigrinus (oncilla) E

Leopardus wiedii (margay) E

Puma concolor (puma) E

Subfamily Pantherinae (large cats)

Panthera onca (jaguar) E

Family Mustelidae (weasels)

Subfamily Lutrinae (otters)

Lontra longicaudis (southern river otter) E

Pteronura brasiliensis (giant river otter) OBS

?

Subfamily Mustelinae (weasels)

Eira barbara (tayra) E

Family Procyonidae (raccoons and allies)

Subfamily Potosinae (kinkajous and olingos)

Potos flavus (kinkajou) E

Subfamily Procyoninae (raccoons and coatis)

Nasua nasua (South American coatis) E

Procyon cancrivorus (crab dog) OBS

ORDER PERISSODACTYLA (odd-toed ungulates)

Family Tapiridae (tapirs)

Tapirus terrestris (Brazilian tapir) E

**ORDER ARTIODACTYLA (even-toed
unugulates)****Family Tayassuidae (peccaries)**Pecari tajacu (collared peccary) **OBS**Tayassu pecari (whited-lipped peccary) **E****Family Cervidae (deer)**Mazama americana (red brocket deer) **OBS**Odocoileus cariacou **E****ORDER RODENTIA (rodents)****Family Sciuridae (squirrels)**Sciurus aestuans (Guianan squirrel) **E****Subfamily Sigmodontinae (New World rats
and mice)**Holochilus sciureus (marsh rat) **E**Neacomys guianae (spiny rat) **E**Neacomys paracou (spiny rat) **E**Nectomys melanius (spiny rat) **E**Oecomys bicolor (arboreal rice rat) **E**Oligoryzomys fulvescens (pygmy rice rat) **E**Oryzomys macconnelli (rice rat) **E**Oryzomys megacephalus (rice rat) **E**Oryzomys yunganus (rice rat) **E**Rhipidomys leucodactylus (climbing rat) **E**Rhipidomys nitela (climbing rat) **E**Sigmodon alstoni **E****Family Erethizontidae (porcupines)**Coendou prehensilis (Brazilian porcupine) **E****Family Caviidae (cavies)**Cavia aperea (cavy) **E****Family Hydrochaeridae (capybaras)**Hydrochaeris hydrochaeris (capybara) **E****Family Dasyproctidae (agoutis and acouchies)**Dasyprocta leporina (red-rumped agouti) **E****Family Cuniculidae (pacas)**Cuniculus paca (paca) **OBS****Subfamily Echimyinae (spiny rats)**Makalata didelphoides (tree rat) **E****Subfamily Eumysopinae (spiny rats)**Mesomys hispidus (spiny tree rat) **E**Proechimys cuvieri (spiny rat) **E**Proechimys guyannensis (spiny rat) **E**



Plate 1: Aerial view of Kaieteur Falls.



Plate 3: The giant bromeliad, *Brocchinia micrantha* (Baker) Mez (Bromeliaceae) in flower.



Plate 2: *Vanilla bicolor* Lindley (Orchidaceae) found in the savannas in the vicinity of Kaieteur Falls. Photo by M. Yoshpa.



Plate 4: The golden frog, *Colostethus beebei* is endemic to Guyana and can be found living in the tanks of the *Brocchinia micrantha* (Baker) Mez at Kaieteur.



Plate 5: *Rapatea paludosa* Aublet (Rapateaceae) grows in the wet sandy soils of the bush islands at Kaieteur.



Plate 6: The cabbage head bromeliad, *Aechmea brassicoides* Baker is endemic to Kaieteur.



Plate 7: One of the cement steps built during British rule along the path to Johnson's View.



Plate 8: Aerial view of the savanna of the Potaro Plateau just south of Kaieteur Falls.